Solution of the equation
$z_1 z_1 z_1 c_1 c_1 c_1 =_F 1$
in a Free Group

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## Contents



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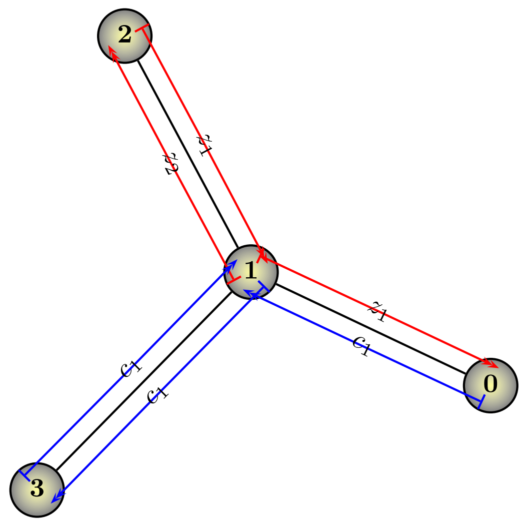
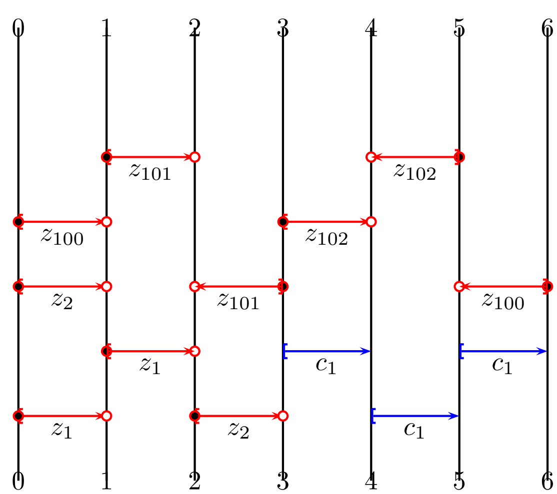
# 1 Cancellation scheme #1




| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $1 \leftarrow 2$ |
| $c_1$ | $3 \leftarrow 1$ |
| $c_1$ | $1 \leftarrow 3$ |
| $c_1$ | $0 \leftarrow 1$ |

### Generalized Equation root-1

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-2:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<1=2*
```

We proceed.

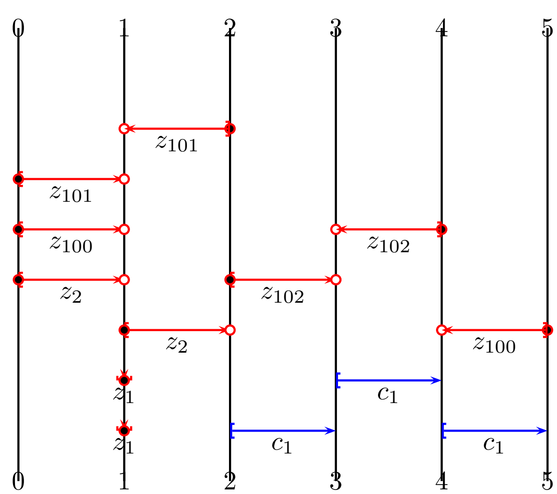
## Generalized Equation root-1.1

We begin from the GE root-1 (see pp. 3). We consider its print

```
Print 1: =0=1*<1=2*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 2.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 2.
Step 3: Moved (old) base [0-1:z100+.] to (new) boundaries 1 - 2.
Step 4: Collapsed (new) base [1-2:z1+.] to the empty base (2,2).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-1.1—is illustrated below:




**GE Information**: Carrier: [0-1:z2+.] ; Carrier Dual: [1-2:z2+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE

tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<1=2*
```

This completes the consideration of root-1.1, as derived from the application of a print to root-1.

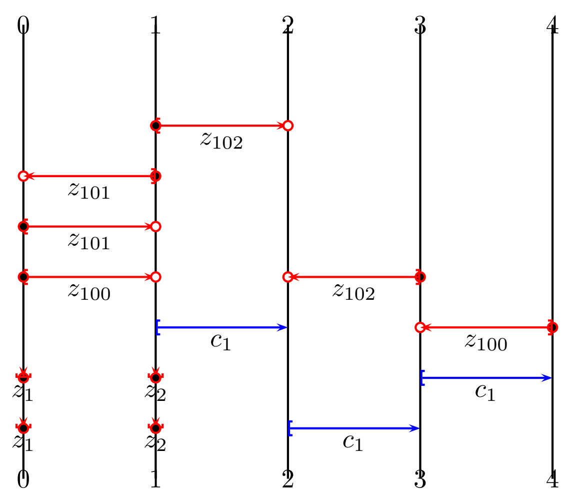
## Generalized Equation root-1.1.1

We begin from the GE root-1.1 (see pp. 4). We consider its print

```
Print 1: =0=1*<1=2*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 2.
Step 2: Moved (old) base [0-1:z100+.] to (new) boundaries 1 - 2.
Step 3: Moved (old) base [0-1:z101+.] to (new) boundaries 1 - 2.
Step 4: Collapsed (new) base [1-2:z2+.] to the empty base (2,2).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-1.1.1—is illustrated below:



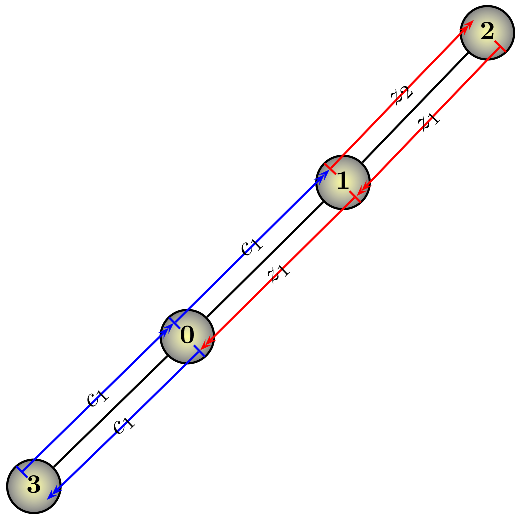

**GE Information**: Carrier: [0-1:z100+.] ; Carrier Dual: [3-4:z100-.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [0-1:z101+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the

$$z_1 z_1 z_1 c_1 c_1 c_1 =_F 1$$

GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-1.1.1, as derived from the application of a print to root-1.1.

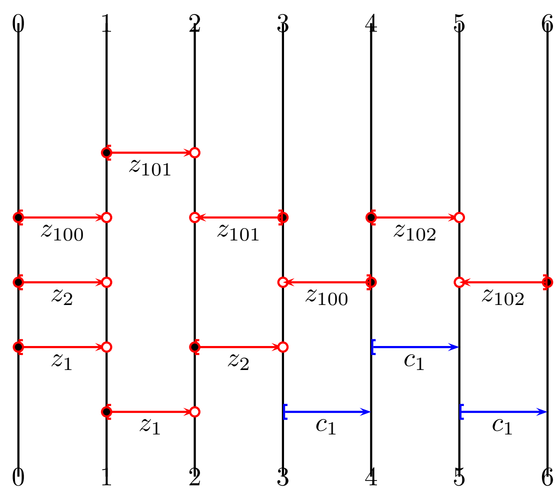
## 2 Cancellation scheme #2




| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $1 \leftarrow 2$ |
| $c_1$ | $0 \leftarrow 1$ |
| $c_1$ | $3 \leftarrow 0$ |
| $c_1$ | $0 \leftarrow 3$ |

### Generalized Equation root-2

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-2:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<1=2*
```

We proceed.

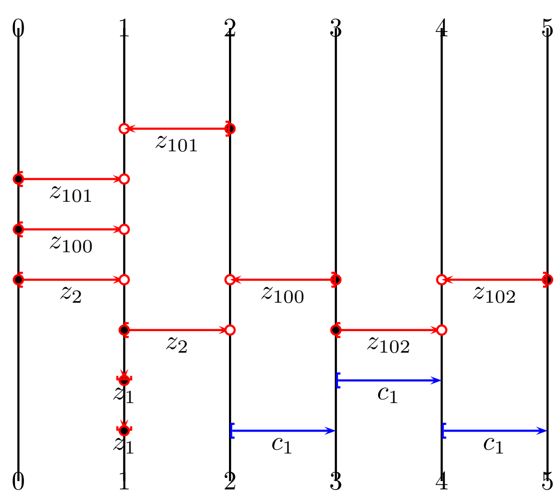
## Generalized Equation root-2.1

We begin from the GE root-2 (see pp. 7). We consider its print

```
Print 1: =0=1*<1=2*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 2.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 2.
Step 3: Moved (old) base [0-1:z100+.] to (new) boundaries 1 - 2.
Step 4: Collapsed (new) base [1-2:z1+.] to the empty base (2,2).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-2.1—is illustrated below:




**GE Information**: Carrier: [0-1:z2+.] ; Carrier Dual: [1-2:z2+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE

tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<1=2*
```

This completes the consideration of root-2.1, as derived from the application of a print to root-2.

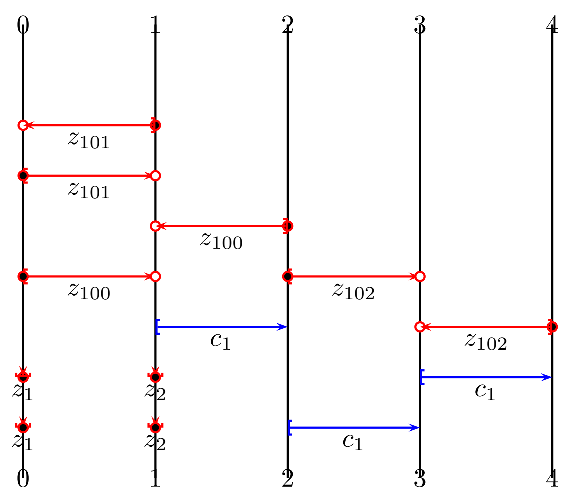
## Generalized Equation root-2.1.1

We begin from the GE root-2.1 (see pp. 8). We consider its print

```
Print 1: =0=1*<1=2*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 2.
Step 2: Moved (old) base [0-1:z100+.] to (new) boundaries 1 - 2.
Step 3: Moved (old) base [0-1:z101+.] to (new) boundaries 1 - 2.
Step 4: Collapsed (new) base [1-2:z2+.] to the empty base (2,2).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-2.1.1—is illustrated below:



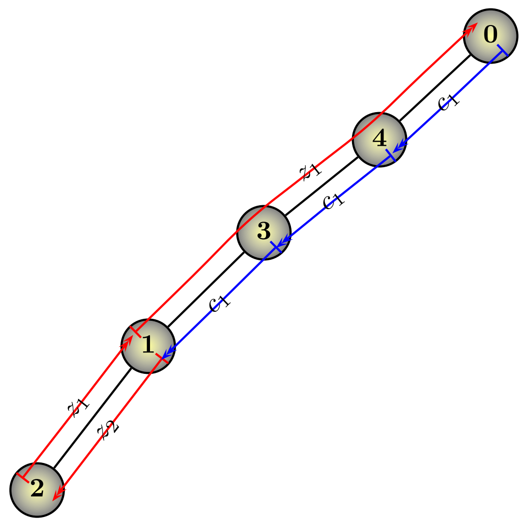

**GE Information**: Carrier: [0-1:z100+.] ; Carrier Dual: [1-2:z100-.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [0-1:z101+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the

$$z_1 z_1 z_1 c_1 c_1 c_1 =_F 1$$

GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-2.1.1, as derived from the application of a print to root-2.1.

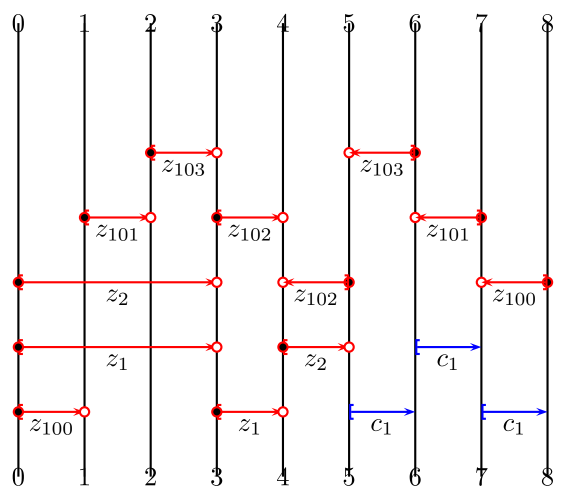
# 3 Cancellation scheme #3




| | |
|---|---|
| $z_1$ | $1 \leftarrow 3 \leftarrow 4 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $1 \leftarrow 2$ |
| $c_1$ | $3 \leftarrow 1$ |
| $c_1$ | $4 \leftarrow 3$ |
| $c_1$ | $0 \leftarrow 4$ |

## Generalized Equation root-3

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-3:z1+.] ; Carrier Dual: [3-4:z1+.] ; Critical Boundary: 3; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=3*<1<2<3=4*
```

We proceed.

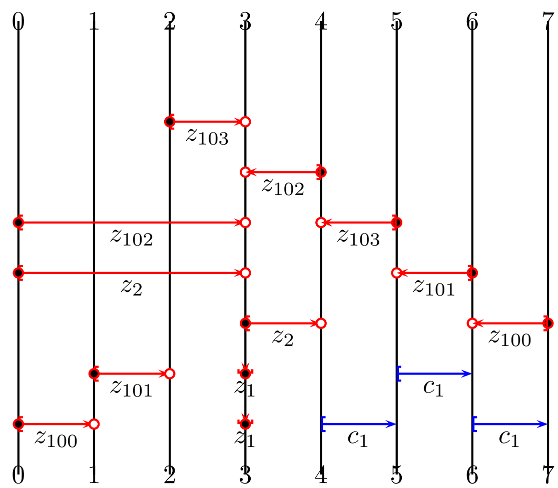
## Generalized Equation root-3.1

We begin from the GE root-3 (see pp. 11). We consider its print

```
Print 1: =0=3*<1<2<3=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 5.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 6.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 6.
Step 5: Moved (old) base [0-1:z100+.] to (new) boundaries 3 - 4.
Step 6: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 5.
Step 7: Moved (old) base [2-3:z103+.] to (new) boundaries 5 - 6.
Step 8: Collapsed (new) base [3-6:z1+.] to the empty base (6,6).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-3.1—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-4:z2+.] ; Critical Boundary: 3; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=3*<1<2<3=4*
```

This completes the consideration of root-3.1, as derived from the application of a print to root-3.

## Generalized Equation root-3.1.1

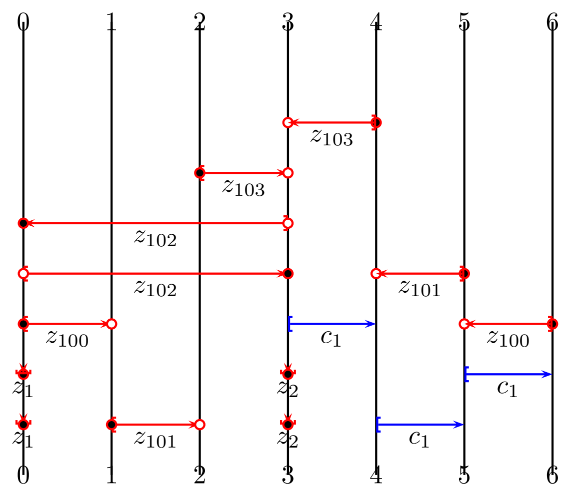
We begin from the GE root-3.1 (see pp. 12). We consider its print

```
Print 1: =0=3*<1<2<3=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 5.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 6.
Step 4: Moved (old) base [0-1:z100+.] to (new) boundaries 3 - 4.
Step 5: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 5.
Step 6: Moved (old) base [0-3:z102+.] to (new) boundaries 3 - 6.
Step 7: Moved (old) base [2-3:z103+.] to (new) boundaries 5 - 6.
Step 8: Collapsed (new) base [3-6:z2+.] to the empty base (6,6).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This

will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

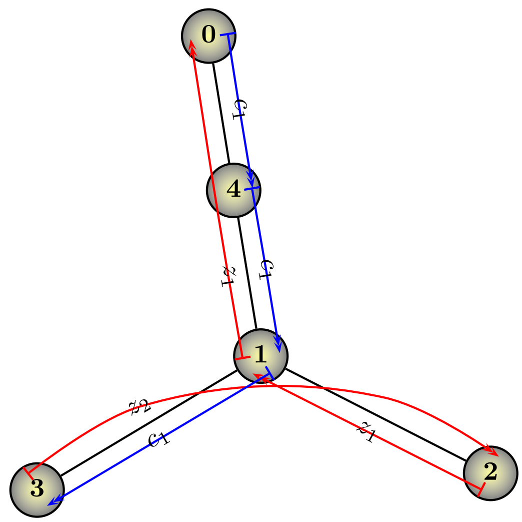
Upon applying the print, the GE we obtain—which we refer to as root-3.1.1—is illustrated below:




**GE Information**: Carrier: [0-3:z102-.] ; Carrier Dual: [0-3:z102+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [0-3:z102+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-3.1.1, as derived from the application of a print to root-3.1.

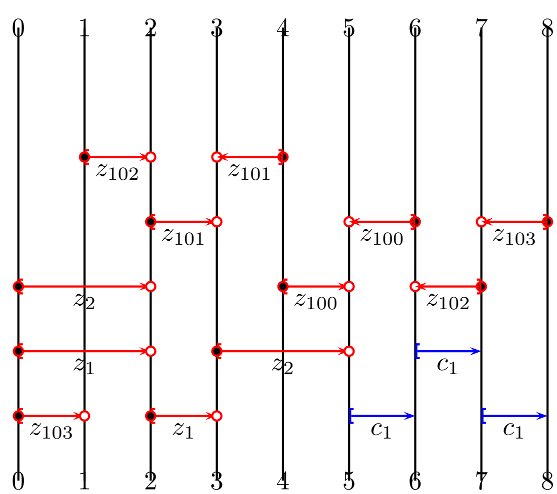
# 4 Cancellation scheme #4




| | |
|---|---|
| $z_1$ | $1 \leftarrow 4 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 1 \leftarrow 2$ |
| $c_1$ | $1 \leftarrow 3$ |
| $c_1$ | $4 \leftarrow 1$ |
| $c_1$ | $0 \leftarrow 4$ |

## Generalized Equation root-4

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-2:z1+.] ; Carrier Dual: [2-3:z1+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1<2=3*
```

We proceed.

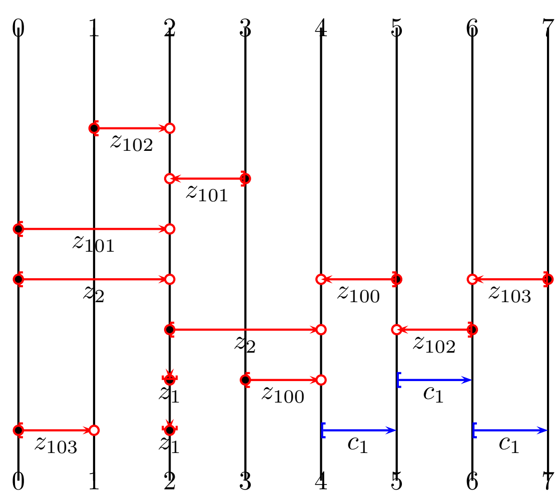
## Generalized Equation root-4.1

We begin from the GE root-4 (see pp. 15). We consider its print

```
Print 1: =0=2*<1<2=3*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 4.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 4.
Step 4: Moved (old) base [1-2:z102+.] to (new) boundaries 3 - 4.
Step 5: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 3.
Step 6: Collapsed (new) base [2-4:z1+.] to the empty base (4,4).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-4.1—is illustrated below:



**GE Information**: Carrier: [0-2:z2+.] ; Carrier Dual: [2-4:z2+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 3 valid prints (descendents).

It has 3 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1=3*<2=4*
Print 2: =0=2*<1<3*<2=4*
Print 3: =0=2*<3*<1<2=4*
```

This completes the consideration of root-4.1, as derived from the application of a print to root-4.

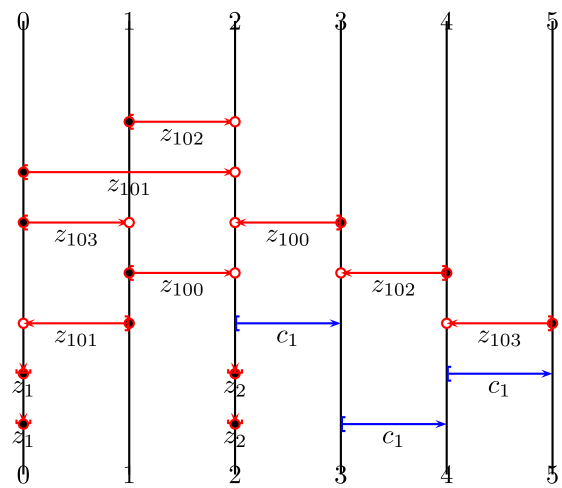
## Generalized Equation root-4.1.1

We begin from the GE root-4.1 (see pp. 16). We consider its print

```
Print 1: =0=2*<1=3*<2=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 4.
Step 2: Moved (old) base [0-2:z101+.] to (new) boundaries 2 - 4.
Step 3: Moved (old) base [1-2:z102+.] to (new) boundaries 3 - 4.
Step 4: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 3.
Step 5: Collapsed (new) base [2-4:z2+.] to the empty base (4,4).
Step 6: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 7: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-4.1.1—is illustrated below:




**GE Information**: Carrier: [0-2:z101+.] ; Carrier Dual: [0-1:z101-.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [0-2:z101+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-4.1.1, as derived from the application of a print to root-4.1.

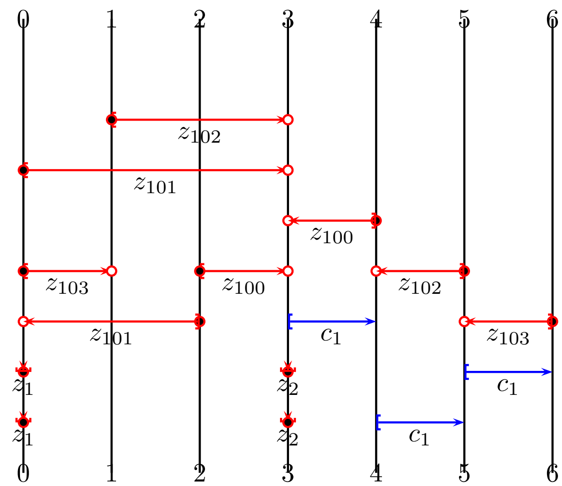
## Generalized Equation root-4.1.2

We begin from the GE root-4.1 (see pp. 16). We consider its print

```
Print 2: =0=2*<1<3*<2=4*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [0-2:z101+.] to (new) boundaries 2 - 5.
Step 4: Moved (old) base [1-2:z102+.] to (new) boundaries 3 - 5.
Step 5: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 3.
Step 6: Collapsed (new) base [2-5:z2+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-4.1.2—is illustrated below:




**GE Information**: Carrier: [0-3:z101+.] ; Carrier Dual: [0-2:z101-.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [0-3:z101+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-4.1.2, as derived from the application of a print to root-4.1.

## Generalized Equation root-4.1.3

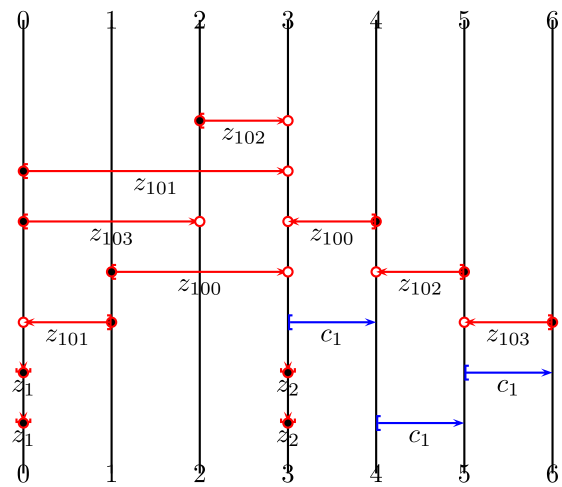
We begin from the GE root-4.1 (see pp. 16). We consider its print

```
Print 3: =0=2*<3*<1<2=4*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [0-2:z101+.] to (new) boundaries 2 - 5.
Step 4: Moved (old) base [1-2:z102+.] to (new) boundaries 4 - 5.
Step 5: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 4.
Step 6: Collapsed (new) base [2-5:z2+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This

will cause renumbering of higher numbered boundaries.

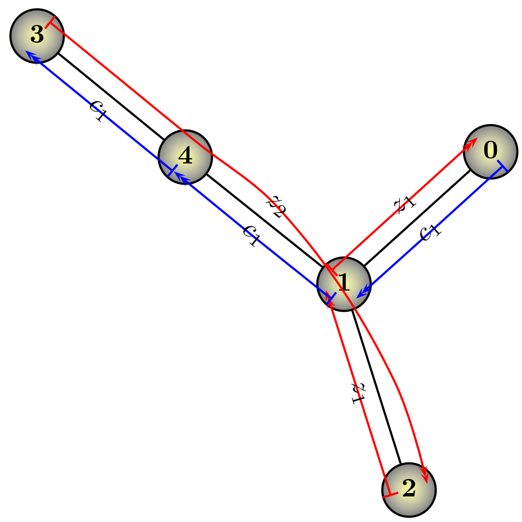
Upon applying the print, the GE we obtain—which we refer to as root-4.1.3—is illustrated below:




**GE Information**: Carrier: [0-3:z101+.] ; Carrier Dual: [0-1:z101-.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [0-3:z101+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-4.1.3, as derived from the application of a print to root-4.1.

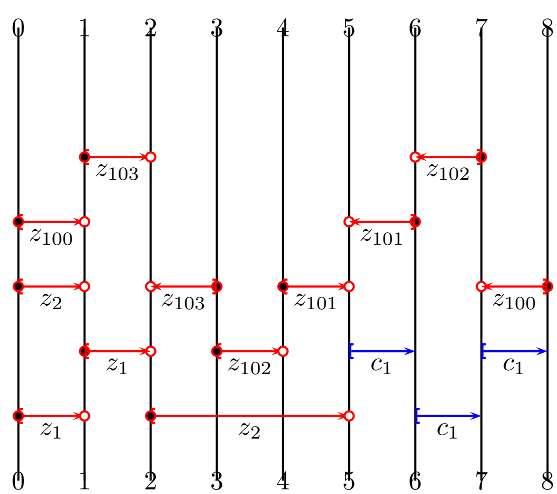
# 5 Cancellation scheme #5




| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 4 \leftarrow 1 \leftarrow 2$ |
| $c_1$ | $4 \leftarrow 3$ |
| $c_1$ | $1 \leftarrow 4$ |
| $c_1$ | $0 \leftarrow 1$ |

## Generalized Equation root-5

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-2:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<1=2*
```

We proceed.

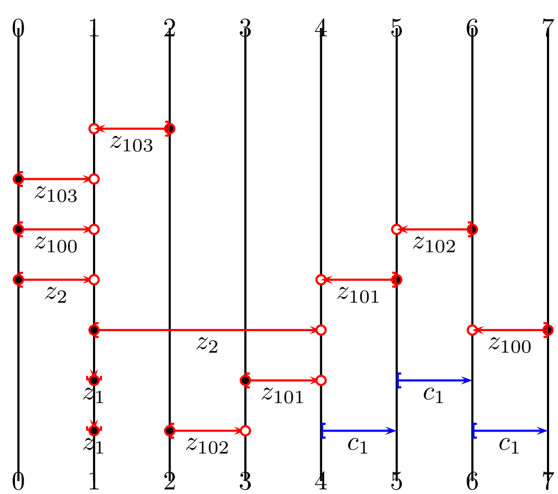
## Generalized Equation root-5.1

We begin from the GE root-5 (see pp. 21). We consider its print

```
Print 1: =0=1*<1=2*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 2.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 2.
Step 3: Moved (old) base [0-1:z100+.] to (new) boundaries 1 - 2.
Step 4: Collapsed (new) base [1-2:z1+.] to the empty base (2,2).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-5.1—is illustrated below:




**GE Information**: Carrier: [0-1:z2+.] ; Carrier Dual: [1-4:z2+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE

tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<2*<3*<1=4*
```

This completes the consideration of root-5.1, as derived from the application of a print to root-5.

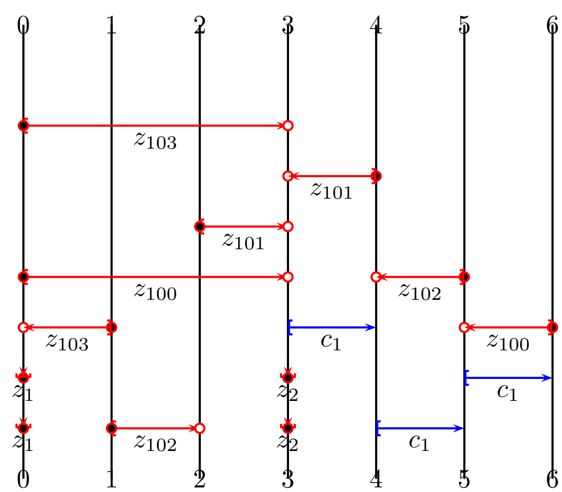
## Generalized Equation root-5.1.1

We begin from the GE root-5.1 (see pp. 22). We consider its print

```
Print 1: =0=1*<2*<3*<1=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 4.
Step 2: Moved (old) base [0-1:z100+.] to (new) boundaries 1 - 4.
Step 3: Moved (old) base [0-1:z103+.] to (new) boundaries 1 - 4.
Step 4: Collapsed (new) base [1-4:z2+.] to the empty base (4,4).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-5.1.1—is illustrated below:



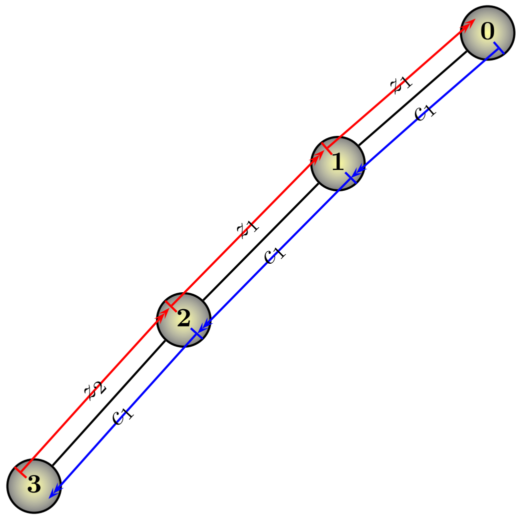

**GE Information**: Carrier: [0-3:z100+.] ; Carrier Dual: [5-6:z100-.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [0-3:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the

$$z_1z_1z_1c_1c_1c_1 =_F 1$$

GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-5.1.1, as derived from the application of a print to root-5.1.

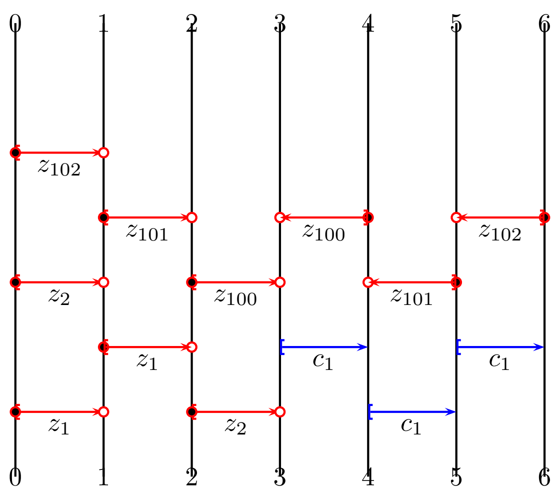
# 6 Cancellation scheme #6




| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 2$ |
| $c_1$ | $2 \leftarrow 3$ |
| $c_1$ | $1 \leftarrow 2$ |
| $c_1$ | $0 \leftarrow 1$ |

### Generalized Equation root-6

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-2:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<1=2*
```

We proceed.

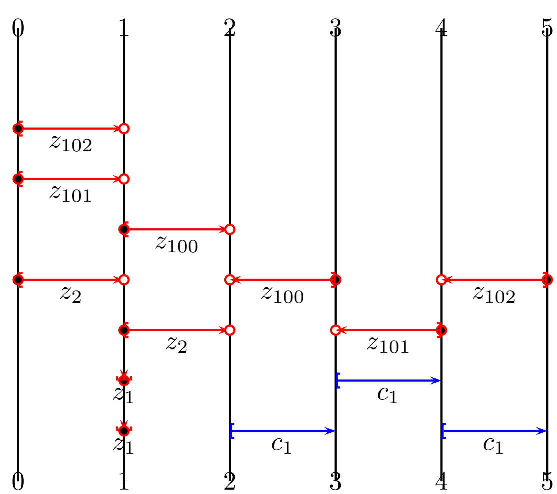
## Generalized Equation root-6.1

We begin from the GE root-6 (see pp. 25). We consider its print

```
Print 1: =0=1*<1=2*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 2.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 2.
Step 3: Moved (old) base [0-1:z102+.] to (new) boundaries 1 - 2.
Step 4: Collapsed (new) base [1-2:z1+.] to the empty base (2,2).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-6.1—is illustrated below:




**GE Information**: Carrier: [0-1:z2+.] ; Carrier Dual: [1-2:z2+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE

tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<1=2*
```

This completes the consideration of root-6.1, as derived from the application of a print to root-6.

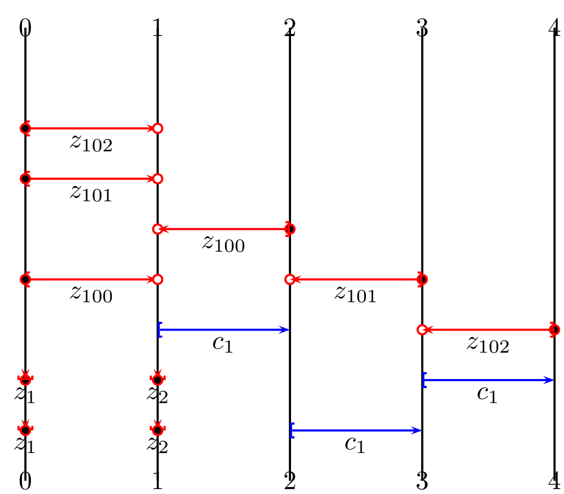
## Generalized Equation root-6.1.1

We begin from the GE root-6.1 (see pp. 26). We consider its print

```
Print 1: =0=1*<1=2*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 2.
Step 2: Moved (old) base [0-1:z101+.] to (new) boundaries 1 - 2.
Step 3: Moved (old) base [0-1:z102+.] to (new) boundaries 1 - 2.
Step 4: Collapsed (new) base [1-2:z2+.] to the empty base (2,2).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-6.1.1—is illustrated below:




**GE Information**: Carrier: [0-1:z100+.] ; Carrier Dual: [1-2:z100-.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1=1*
```

This completes the consideration of root-6.1.1, as derived from the application of a print to root-6.1.

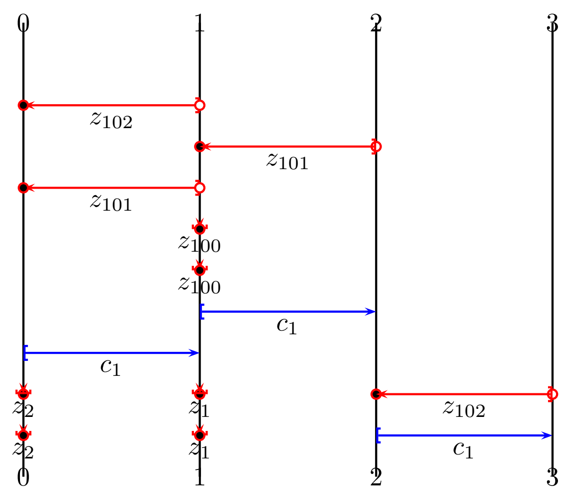
## Generalized Equation root-6.1.1.1

We begin from the GE root-6.1.1 (see pp. 27). We consider its print

```
Print 1: =0=2*<1=1*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z100+.] to (new) boundaries 2 - 1.
Step 2: Moved (old) base [0-0:z1+.] to (new) boundaries 2 - 2.
Step 3: Moved (old) base [0-0:z1+.] to (new) boundaries 2 - 2.
Step 4: Moved (old) base [0-1:z101+.] to (new) boundaries 2 - 1.
Step 5: Moved (old) base [0-1:z102+.] to (new) boundaries 2 - 1.
Step 6: Collapsed (new) base [1-2:z100-.] to the empty base (2,2).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-6.1.1.1—is illustrated below:




**GE Information**: Carrier: [0-1:z101-.] ; Carrier Dual: [1-2:z101-.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<1=2*
```

This completes the consideration of root-6.1.1.1, as derived from the application of a print to root-6.1.1.

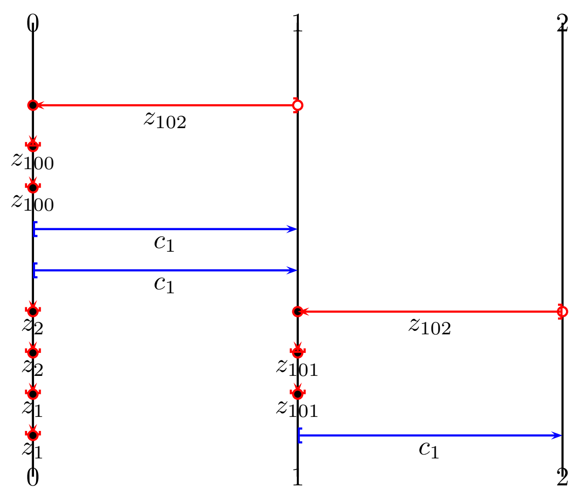
## Generalized Equation root-6.1.1.1.1

We begin from the GE root-6.1.1.1 (see pp. 28). We consider its print

```
Print 1: =0=1*<1=2*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z101-.] to (new) boundaries 1 - 2.
Step 2: Moved (old) base [0-0:z2+.] to (new) boundaries 1 - 1.
Step 3: Moved (old) base [0-0:z2+.] to (new) boundaries 1 - 1.
Step 4: Moved (old) base [0-1:c1+.] to (new) boundaries 1 - 2.
Step 5: Moved (old) base [0-1:z102-.] to (new) boundaries 1 - 2.
Step 6: Collapsed (new) base [1-2:z101-.] to the empty base (2,2).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-6.1.1.1.1—is illustrated below:




**GE Information**: Carrier: [0-1:z102-.] ; Carrier Dual: [1-2:z102-.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<1=2*
```

This completes the consideration of root-6.1.1.1.1, as derived from the application of a print to root-6.1.1.1.

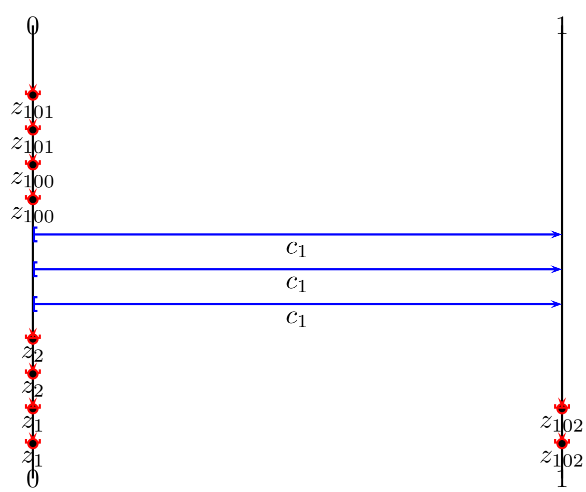
## Generalized Equation root-6.1.1.1.1.1

We begin from the GE root-6.1.1.1.1 (see pp. 29). We consider its print

```
Print 1: =0=1*<1=2*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z102-.] to (new) boundaries 1 - 2.
Step 2: Moved (old) base [0-0:z1+.] to (new) boundaries 1 - 1.
Step 3: Moved (old) base [0-0:z1+.] to (new) boundaries 1 - 1.
Step 4: Moved (old) base [0-0:z2+.] to (new) boundaries 1 - 1.
Step 5: Moved (old) base [0-0:z2+.] to (new) boundaries 1 - 1.
Step 6: Moved (old) base [0-1:c1+.] to (new) boundaries 1 - 2.
Step 7: Moved (old) base [0-1:c1+.] to (new) boundaries 1 - 2.
Step 8: Moved (old) base [0-0:z100-.] to (new) boundaries 1 - 1.
Step 9: Moved (old) base [0-0:z100-.] to (new) boundaries 1 - 1.
Step 10: Collapsed (new) base [1-2:z102-.] to the empty base (2,2).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-6.1.1.1.1.1—is illustrated below:



$$z_1 z_1 z_1 c_1 c_1 c_1 =_F 1$$

---

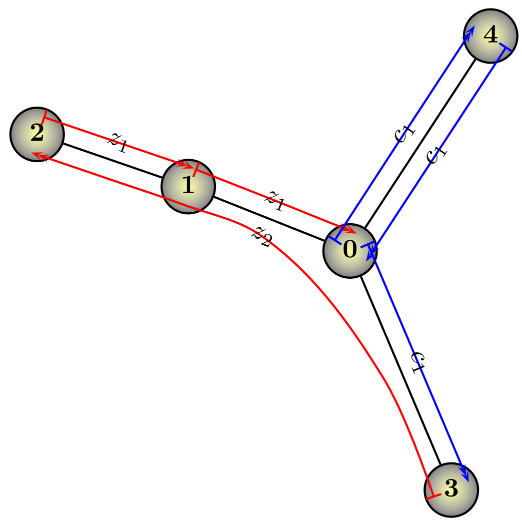
**GE Information**: Carrier: [0-0:z1+.] ; Carrier Dual: [0-0:z1+.] ; Critical Boundary: 0; The GE above is non-degenerate. This GE is a leaf in the GE tree. We have effectively found a solution!

| variable | value |
|---|---|
| $z_{101}^{-1}$ | $c_1 =_F 1$ |
| $z_{102}$ | $c_1^{-1} =_F 1$ |
| $z_{100}^{-1}$ | $c_1 =_F 1$ |
| $z_{100}$ | $c_1^{-1} =_F 1$ |
| $z_1$ | $c_1^{-1} =_F 1$ |
| $z_{102}^{-1}$ | $c_1 =_F 1$ |
| $z_{101}$ | $c_1^{-1} =_F 1$ |
| $z_2^{-1}$ | $c_1 =_F 1$ |
| $z_2$ | $c_1^{-1} =_F 1$ |
| $z_1^{-1}$ | $c_1 =_F 1$ |

The above table shows the values of the solution, as obtained by tracing upwards from this trivially true GE, to the root of the Makanin-Razborov tree.

This completes the consideration of root-6.1.1.1.1.1, as derived from the application of a print to root-6.1.1.1.1.

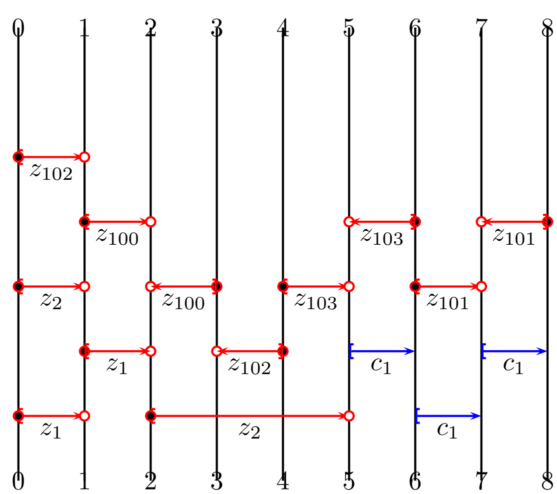
# 7 Cancellation scheme #7




| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 0 \leftarrow 1 \leftarrow 2$ |
| $c_1$ | $0 \leftarrow 3$ |
| $c_1$ | $4 \leftarrow 0$ |
| $c_1$ | $0 \leftarrow 4$ |

## Generalized Equation root-7

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-2:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<1=2*
```

We proceed.

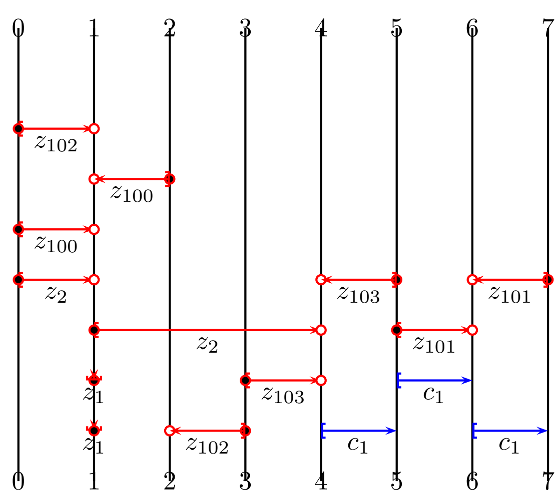
## Generalized Equation root-7.1

We begin from the GE root-7 (see pp. 32). We consider its print

```
Print 1: =0=1*<1=2*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 2.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 2.
Step 3: Moved (old) base [0-1:z102+.] to (new) boundaries 1 - 2.
Step 4: Collapsed (new) base [1-2:z1+.] to the empty base (2,2).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-7.1—is illustrated below:




**GE Information**: Carrier: [0-1:z2+.] ; Carrier Dual: [1-4:z2+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE

tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<2*<3*<1=4*
```

This completes the consideration of root-7.1, as derived from the application of a print to root-7.

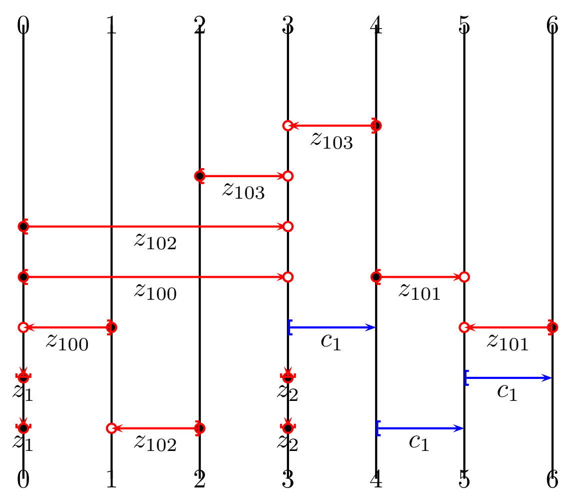
## Generalized Equation root-7.1.1

We begin from the GE root-7.1 (see pp. 33). We consider its print

```
Print 1: =0=1*<2*<3*<1=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 4.
Step 2: Moved (old) base [0-1:z100+.] to (new) boundaries 1 - 4.
Step 3: Moved (old) base [0-1:z102+.] to (new) boundaries 1 - 4.
Step 4: Collapsed (new) base [1-4:z2+.] to the empty base (4,4).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-7.1.1—is illustrated below:

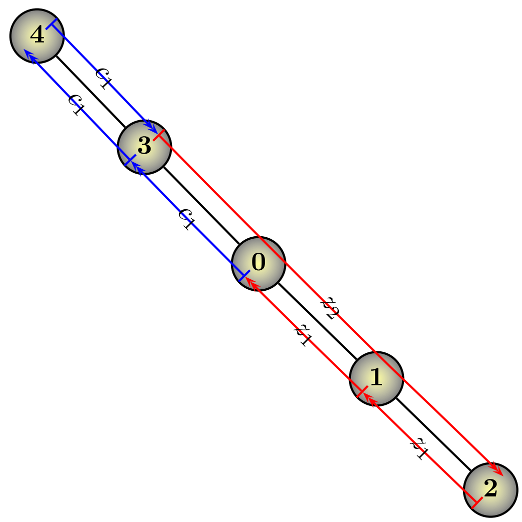



**GE Information**: Carrier: [0-3:z100+.] ; Carrier Dual: [0-1:z100-.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [0-3:z100+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z100-.] and its dual are of opposite polarity, yet intersect. The base [0-3:z102+.] and its dual

are of opposite polarity, yet intersect. The base [1-2:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-7.1.1, as derived from the application of a print to root-7.1.

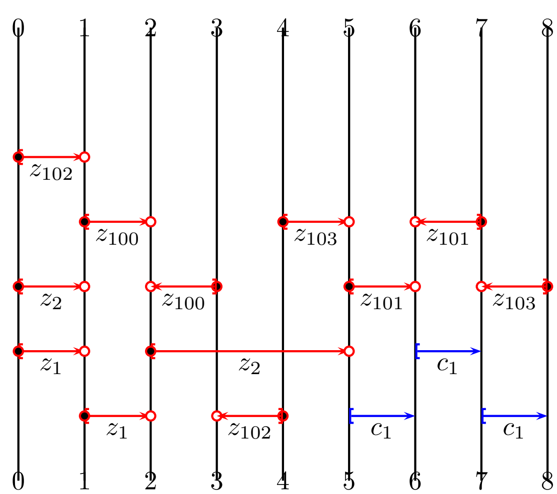
# 8 Cancellation scheme #8




| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 0 \leftarrow 1 \leftarrow 2$ |
| $c_1$ | $4 \leftarrow 3$ |
| $c_1$ | $3 \leftarrow 4$ |
| $c_1$ | $0 \leftarrow 3$ |

## Generalized Equation root-8

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-2:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<1=2*
```

We proceed.

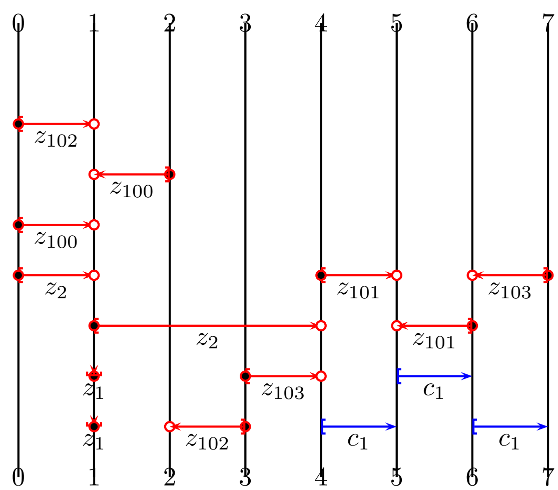
## Generalized Equation root-8.1

We begin from the GE root-8 (see pp. 36). We consider its print

```
Print 1: =0=1*<1=2*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 2.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 2.
Step 3: Moved (old) base [0-1:z102+.] to (new) boundaries 1 - 2.
Step 4: Collapsed (new) base [1-2:z1+.] to the empty base (2,2).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-8.1—is illustrated below:




**GE Information**: Carrier: [0-1:z2+.] ; Carrier Dual: [1-4:z2+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE

tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<2*<3*<1=4*
```

This completes the consideration of root-8.1, as derived from the application of a print to root-8.

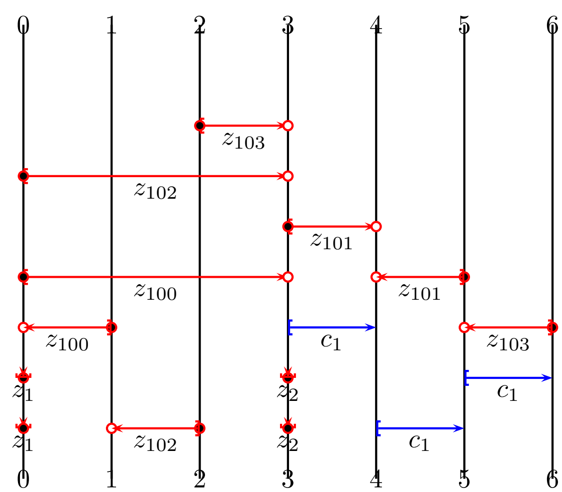
## Generalized Equation root-8.1.1

We begin from the GE root-8.1 (see pp. 37). We consider its print

```
Print 1: =0=1*<2*<3*<1=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 4.
Step 2: Moved (old) base [0-1:z100+.] to (new) boundaries 1 - 4.
Step 3: Moved (old) base [0-1:z102+.] to (new) boundaries 1 - 4.
Step 4: Collapsed (new) base [1-4:z2+.] to the empty base (4,4).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-8.1.1—is illustrated below:

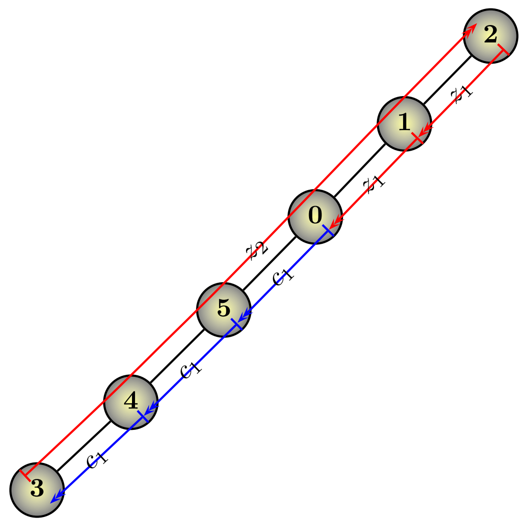



**GE Information**: Carrier: [0-3:z100+.] ; Carrier Dual: [0-1:z100-.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [0-3:z100+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z100-.] and its dual are of opposite polarity, yet intersect. The base [0-3:z102+.] and its dual

are of opposite polarity, yet intersect. The base [1-2:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-8.1.1, as derived from the application of a print to root-8.1.

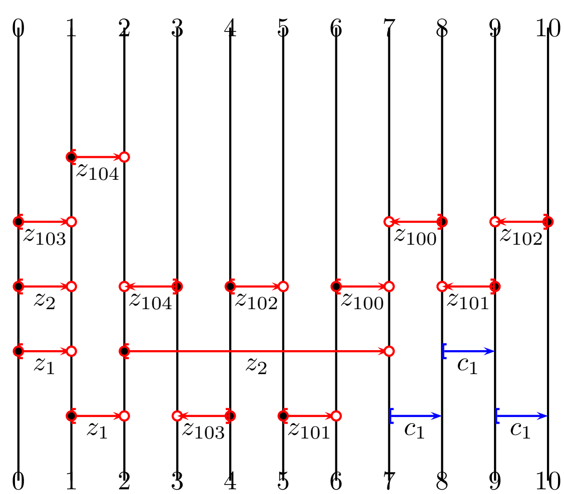
# 9 Cancellation scheme #9




| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 4 \leftarrow 5 \leftarrow 0 \leftarrow 1 \leftarrow 2$ |
| $c_1$ | $4 \leftarrow 3$ |
| $c_1$ | $5 \leftarrow 4$ |
| $c_1$ | $0 \leftarrow 5$ |

## Generalized Equation root-9

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-2:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<1=2*
```

We proceed.

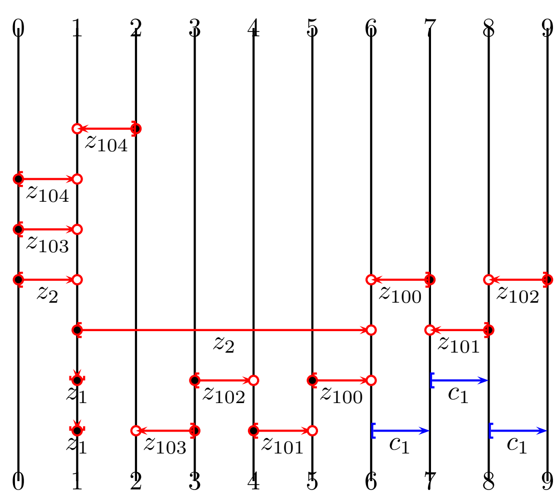
## Generalized Equation root-9.1

We begin from the GE root-9 (see pp. 40). We consider its print

```
Print 1: =0=1*<1=2*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 2.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 2.
Step 3: Moved (old) base [0-1:z103+.] to (new) boundaries 1 - 2.
Step 4: Collapsed (new) base [1-2:z1+.] to the empty base (2,2).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-9.1—is illustrated below:




**GE Information**: Carrier: [0-1:z2+.] ; Carrier Dual: [1-6:z2+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE

tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<2*<3*<4*<5*<1=6*
```

This completes the consideration of root-9.1, as derived from the application of a print to root-9.

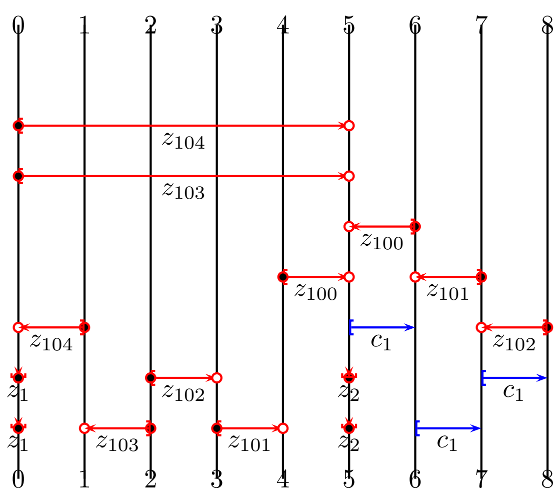
## Generalized Equation root-9.1.1

We begin from the GE root-9.1 (see pp. 41). We consider its print

```
Print 1: =0=1*<2*<3*<4*<5*<1=6*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 6.
Step 2: Moved (old) base [0-1:z103+.] to (new) boundaries 1 - 6.
Step 3: Moved (old) base [0-1:z104+.] to (new) boundaries 1 - 6.
Step 4: Collapsed (new) base [1-6:z2+.] to the empty base (6,6).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-9.1.1—is illustrated below:

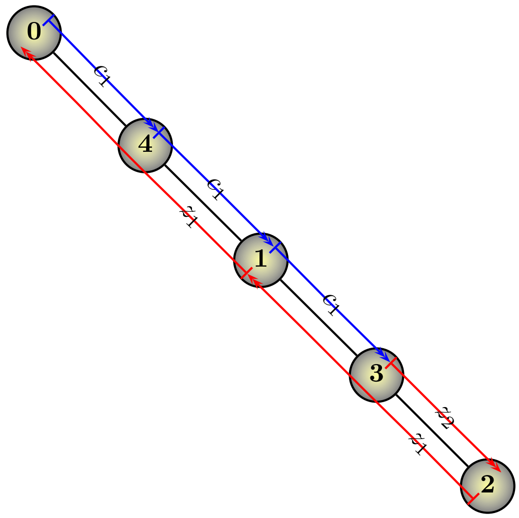



**GE Information**: Carrier: [0-5:z103+.] ; Carrier Dual: [1-2:z103-.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [0-5:z103+.] and its dual are of opposite polarity, yet intersect. The base [1-2:z103-.] and its dual are of opposite polarity, yet intersect. The base [0-5:z104+.] and its dual

are of opposite polarity, yet intersect. The base [0-1:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-9.1.1, as derived from the application of a print to root-9.1.

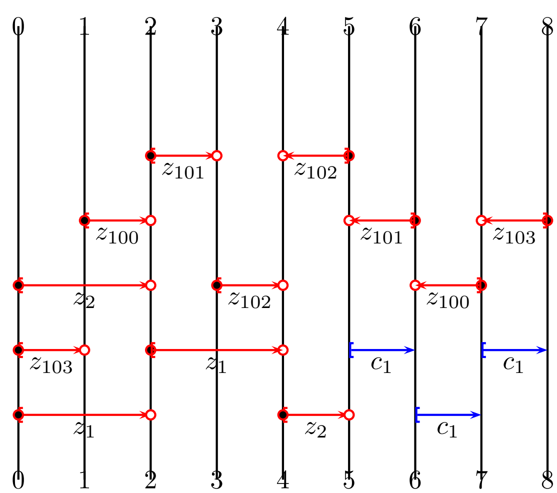
# 10 Cancellation scheme #10




| | |
|---|---|
| $z_1$ | $1 \leftarrow 4 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 3 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 2$ |
| $c_1$ | $1 \leftarrow 3$ |
| $c_1$ | $4 \leftarrow 1$ |
| $c_1$ | $0 \leftarrow 4$ |

## Generalized Equation root-10

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-2:z1+.] ; Carrier Dual: [2-4:z1+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 3 valid prints (descendents).

It has 3 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1=3*<2=4*
Print 2: =0=2*<1<3*<2=4*
Print 3: =0=2*<3*<1<2=4*
```

We proceed.

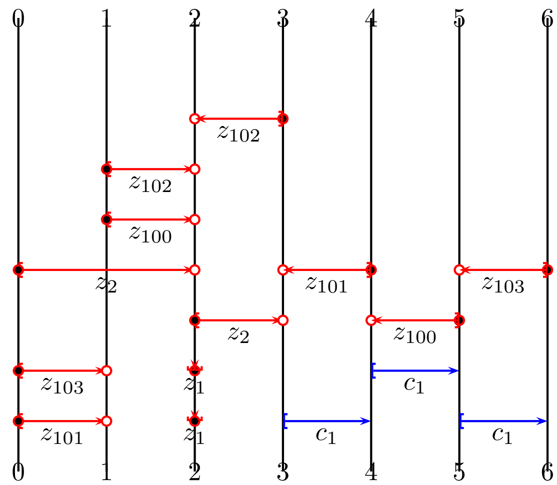
## Generalized Equation root-10.1

We begin from the GE root-10 (see pp. 44). We consider its print

```
Print 1: =0=2*<1=3*<2=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 4.
Step 2: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 4.
Step 3: Moved (old) base [1-2:z100+.] to (new) boundaries 3 - 4.
Step 4: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 3.
Step 5: Collapsed (new) base [2-4:z1+.] to the empty base (4,4).
Step 6: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 7: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-10.1—is illustrated below:




**GE Information**: Carrier: [0-2:z2+.] ; Carrier Dual: [2-3:z2+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1<2=3*
```

This completes the consideration of root-10.1, as derived from the application of a print to root-10.

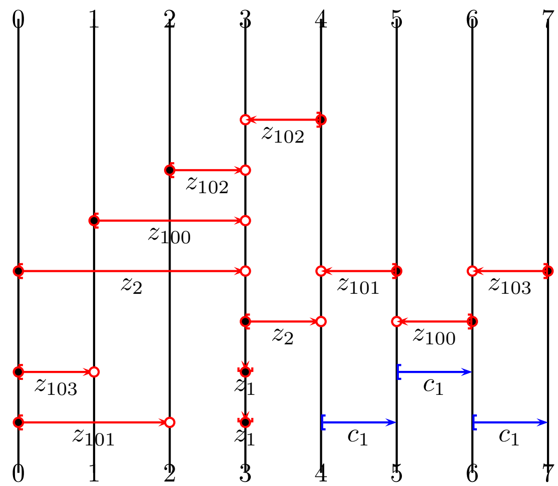
## Generalized Equation root-10.2

We begin from the GE root-10 (see pp. 44). We consider its print

```
Print 2: =0=2*<1<3*<2=4*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 4: Moved (old) base [1-2:z100+.] to (new) boundaries 3 - 5.
Step 5: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 3.
Step 6: Collapsed (new) base [2-5:z1+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-10.2—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-4:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [4-5:z101-.] has constraints with its dual that stretch the constant segment 4 - 5 to length different from 1. The base [5-6:z100-.] has constraints with its dual that stretch the constant segment 5 - 6 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-10.2, as derived from the application of a print to root-10.

## Generalized Equation root-10.3

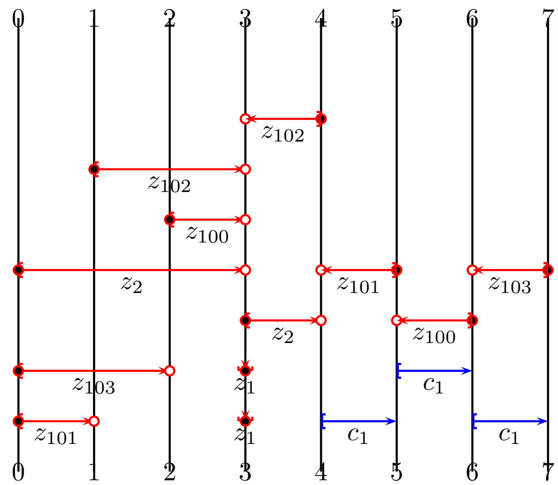
We begin from the GE root-10 (see pp. 44). We consider its print

```
Print 3: =0=2*<3*<1<2=4*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 4: Moved (old) base [1-2:z100+.] to (new) boundaries 4 - 5.
Step 5: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 4.
Step 6: Collapsed (new) base [2-5:z1+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-10.3—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-4:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [6-7:z103-.] has constraints with its dual that stretch the constant segment 6 - 7 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-10.3, as derived from the application of a print to root-10.

## Generalized Equation root-10.1.1

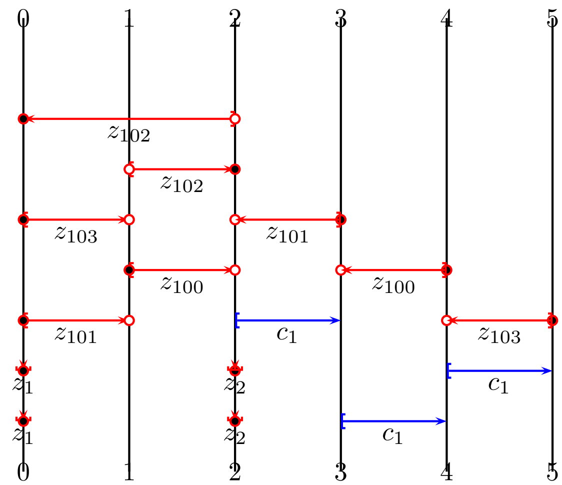
We begin from the GE root-10.1 (see pp. 45). We consider its print

```
Print 1: =0=2*<1<2=3*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 4.
Step 3: Moved (old) base [1-2:z100+.] to (new) boundaries 3 - 4.
Step 4: Moved (old) base [0-1:z101+.] to (new) boundaries 2 - 3.
Step 5: Moved (old) base [1-2:z102+.] to (new) boundaries 3 - 4.
Step 6: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 3.

Step 7: Collapsed (new) base [2-4:z2+.] to the empty base (4,4).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

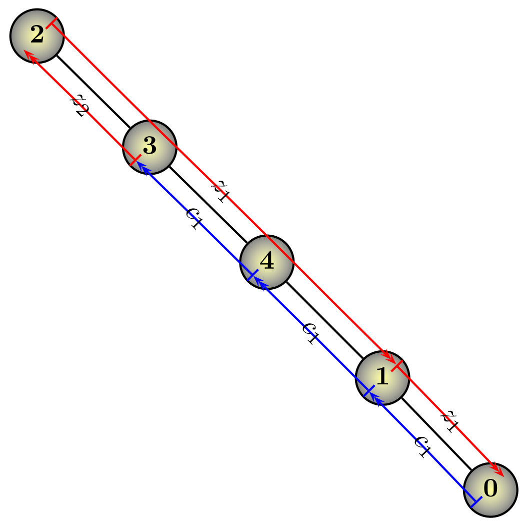
Upon applying the print, the GE we obtain—which we refer to as root-10.1.1—is illustrated below:




**GE Information**: Carrier: [0-2:z102-.] ; Carrier Dual: [1-2:z102+.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [1-2:z102+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-10.1.1, as derived from the application of a print to root-10.1.

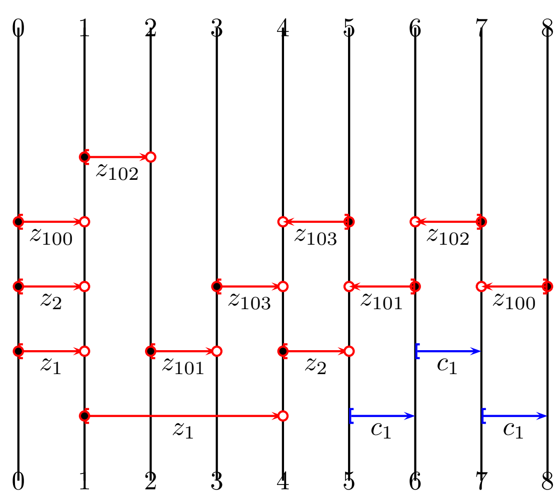
# 11 Cancellation scheme #11




| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 3 \leftarrow 4 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 2$ |
| $c_1$ | $4 \leftarrow 3$ |
| $c_1$ | $1 \leftarrow 4$ |
| $c_1$ | $0 \leftarrow 1$ |

## Generalized Equation root-11

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-4:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<2*<3*<1=4*
```

We proceed.

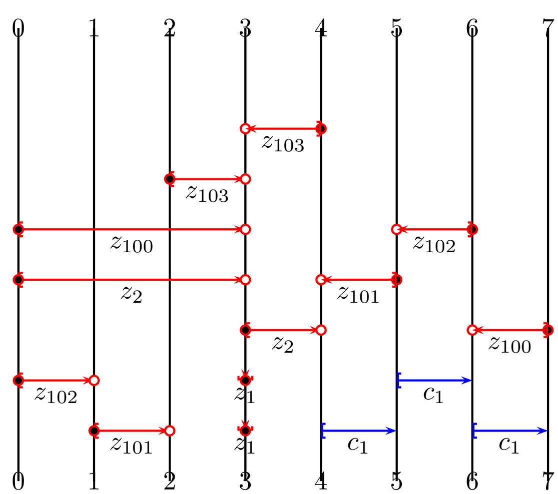
## Generalized Equation root-11.1

We begin from the GE root-11 (see pp. 50). We consider its print

```
Print 1: =0=1*<2*<3*<1=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 4.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 4.
Step 3: Moved (old) base [0-1:z100+.] to (new) boundaries 1 - 4.
Step 4: Collapsed (new) base [1-4:z1+.] to the empty base (4,4).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-11.1—is illustrated below:

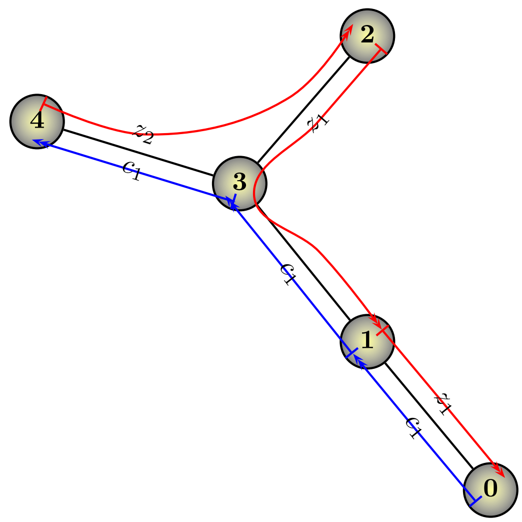



**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-4:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [6-7:z100-.]

has constraints with its dual that stretch the constant segment 6 - 7 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-11.1, as derived from the application of a print to root-11.

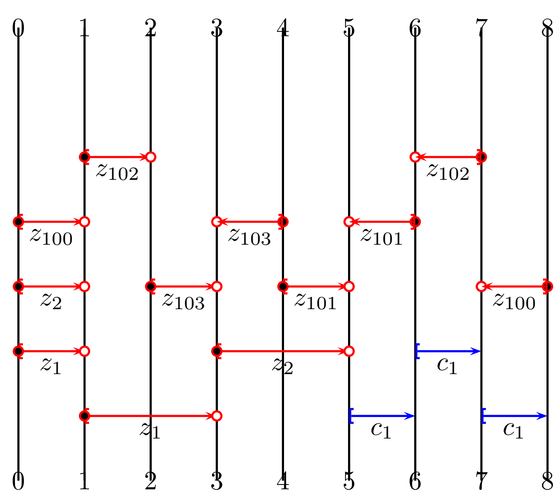
# 12 Cancellation scheme #12




| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 3 \leftarrow 1$ |
| $z_2$ | $4 \leftarrow 3 \leftarrow 2$ |
| $c_1$ | $3 \leftarrow 4$ |
| $c_1$ | $1 \leftarrow 3$ |
| $c_1$ | $0 \leftarrow 1$ |

## Generalized Equation root-12

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-3:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<2*<1=3*
```

We proceed.

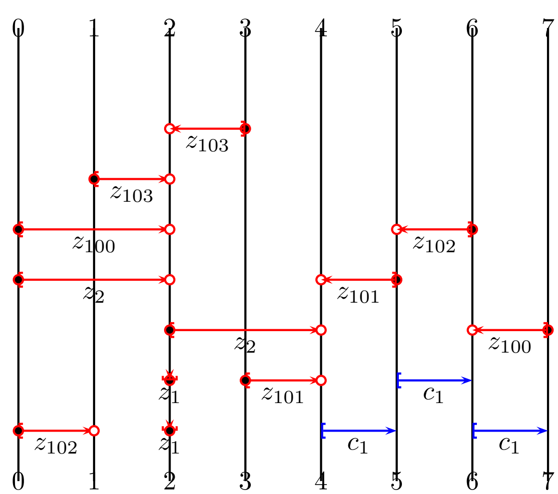
## Generalized Equation root-12.1

We begin from the GE root-12 (see pp. 53). We consider its print

```
Print 1: =0=1*<2*<1=3*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 3.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 3.
Step 3: Moved (old) base [0-1:z100+.] to (new) boundaries 1 - 3.
Step 4: Collapsed (new) base [1-3:z1+.] to the empty base (3,3).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-12.1—is illustrated below:

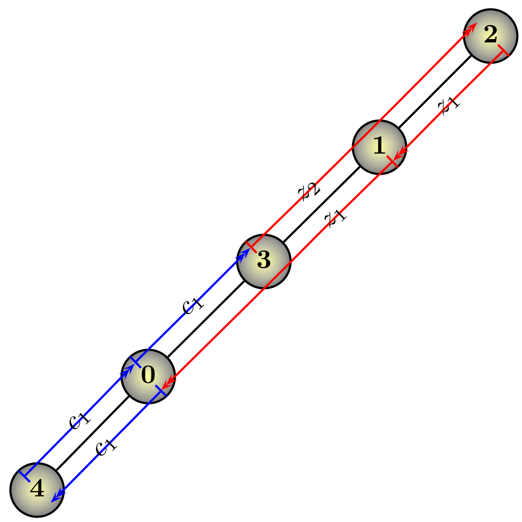



**GE Information**: Carrier: [0-2:z2+.] ; Carrier Dual: [2-4:z2+.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [6-7:z100-.]

has constraints with its dual that stretch the constant segment 6 - 7 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-12.1, as derived from the application of a print to root-12.

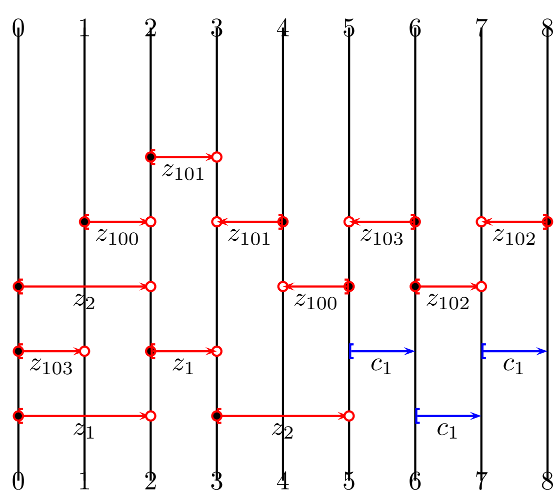
# 13 Cancellation scheme #13




| | |
|---|---|
| $z_1$ | $1 \leftarrow 3 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 1 \leftarrow 2$ |
| $c_1$ | $0 \leftarrow 3$ |
| $c_1$ | $4 \leftarrow 0$ |
| $c_1$ | $0 \leftarrow 4$ |

## Generalized Equation root-13

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-2:z1+.] ; Carrier Dual: [2-3:z1+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1<2=3*
```

We proceed.

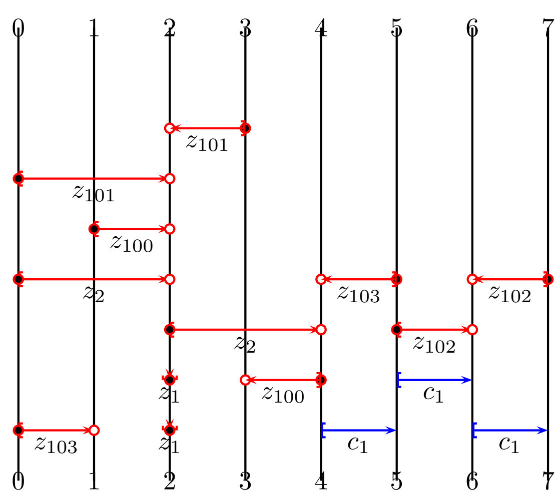
## Generalized Equation root-13.1

We begin from the GE root-13 (see pp. 56). We consider its print

```
Print 1: =0=2*<1<2=3*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 4.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 4.
Step 4: Moved (old) base [1-2:z100+.] to (new) boundaries 3 - 4.
Step 5: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 3.
Step 6: Collapsed (new) base [2-4:z1+.] to the empty base (4,4).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-13.1—is illustrated below:



**GE Information**: Carrier: [0-2:z2+.] ; Carrier Dual: [2-4:z2+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 3 valid prints (descendents).

It has 3 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1=3*<2=4*
Print 2: =0=2*<1<3*<2=4*
Print 3: =0=2*<3*<1<2=4*
```

This completes the consideration of root-13.1, as derived from the application of a print to root-13.

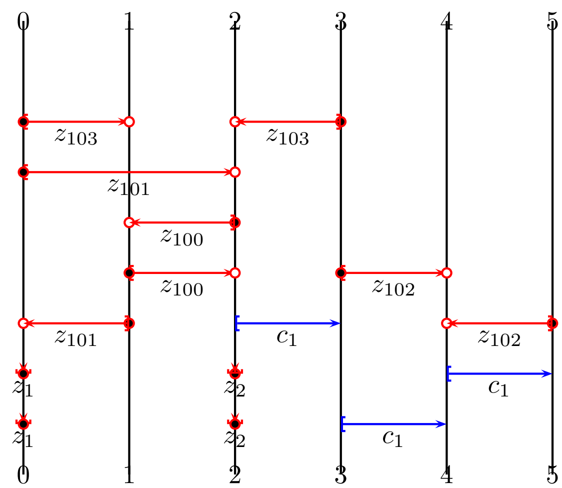
## Generalized Equation root-13.1.1

We begin from the GE root-13.1 (see pp. 57). We consider its print

```
Print 1: =0=2*<1=3*<2=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 4.
Step 2: Moved (old) base [1-2:z100+.] to (new) boundaries 3 - 4.
Step 3: Moved (old) base [0-2:z101+.] to (new) boundaries 2 - 4.
Step 4: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 3.
Step 5: Collapsed (new) base [2-4:z2+.] to the empty base (4,4).
Step 6: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 7: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-13.1.1—is illustrated below:




**GE Information**: Carrier: [0-2:z101+.] ; Carrier Dual: [0-1:z101-.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [1-2:z100+.] and its dual are of opposite polarity, yet intersect. The base [1-2:z100-.] and its dual are of opposite polarity, yet intersect. The base [0-2:z101+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-13.1.1, as derived from the application of a print to root-13.1.

## Generalized Equation root-13.1.2

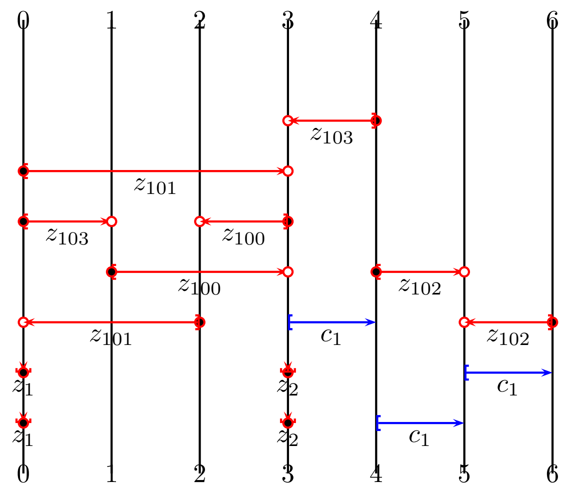
We begin from the GE root-13.1 (see pp. 57). We consider its print

```
Print 2: =0=2*<1<3*<2=4*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [1-2:z100+.] to (new) boundaries 3 - 5.
Step 4: Moved (old) base [0-2:z101+.] to (new) boundaries 2 - 5.
Step 5: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 3.
Step 6: Collapsed (new) base [2-5:z2+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This

will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-13.1.2—is illustrated below:




**GE Information**: Carrier: [0-3:z101+.] ; Carrier Dual: [0-2:z101-.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [1-3:z100+.] and its dual are of opposite polarity, yet intersect. The base [2-3:z100-.] and its dual are of opposite polarity, yet intersect. The base [0-3:z101+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-13.1.2, as derived from the application of a print to root-13.1.

## Generalized Equation root-13.1.3

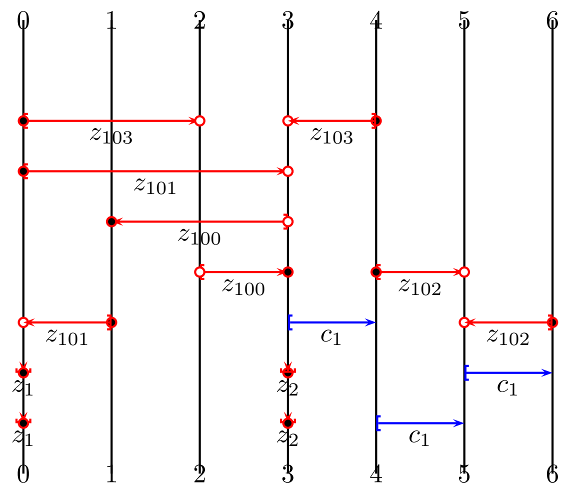
We begin from the GE root-13.1 (see pp. 57). We consider its print

```
Print 3: =0=2*<3*<1<2=4*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [1-2:z100+.] to (new) boundaries 4 - 5.
Step 4: Moved (old) base [0-2:z101+.] to (new) boundaries 2 - 5.
Step 5: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 4.

Step 6: Collapsed (new) base [2-5:z2+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

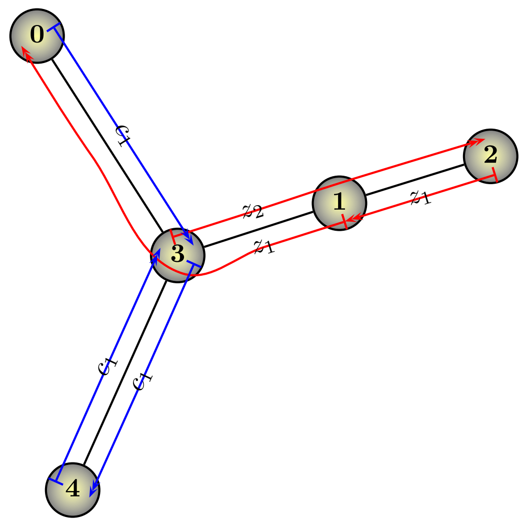
Upon applying the print, the GE we obtain—which we refer to as root-13.1.3—is illustrated below:




**GE Information**: Carrier: [0-3:z101+.] ; Carrier Dual: [0-1:z101-.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [2-3:z100+.] and its dual are of opposite polarity, yet intersect. The base [1-3:z100-.] and its dual are of opposite polarity, yet intersect. The base [0-3:z101+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-13.1.3, as derived from the application of a print to root-13.1.

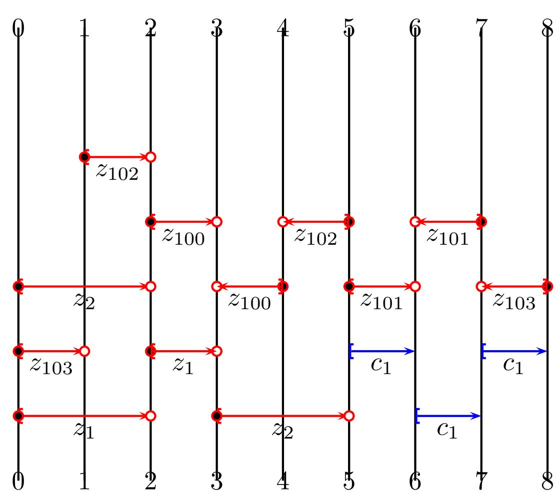
# 14 Cancellation scheme #14




| | |
|---|---|
| $z_1$ | $1 \leftarrow 3 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 1 \leftarrow 2$ |
| $c_1$ | $4 \leftarrow 3$ |
| $c_1$ | $3 \leftarrow 4$ |
| $c_1$ | $0 \leftarrow 3$ |

## Generalized Equation root-14

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-2:z1+.] ; Carrier Dual: [2-3:z1+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1<2=3*
```

We proceed.

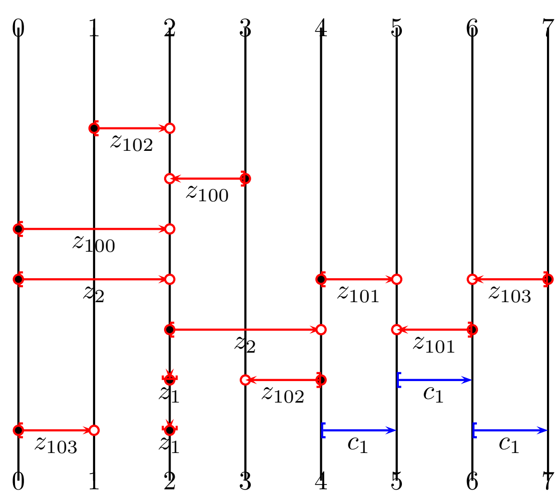
## Generalized Equation root-14.1

We begin from the GE root-14 (see pp. 62). We consider its print

```
Print 1: =0=2*<1<2=3*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 4.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 4.
Step 4: Moved (old) base [1-2:z102+.] to (new) boundaries 3 - 4.
Step 5: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 3.
Step 6: Collapsed (new) base [2-4:z1+.] to the empty base (4,4).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-14.1—is illustrated below:



**GE Information**: Carrier: [0-2:z2+.] ; Carrier Dual: [2-4:z2+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 3 valid prints (descendents).

It has 3 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1=3*<2=4*
Print 2: =0=2*<1<3*<2=4*
Print 3: =0=2*<3*<1<2=4*
```

This completes the consideration of root-14.1, as derived from the application of a print to root-14.

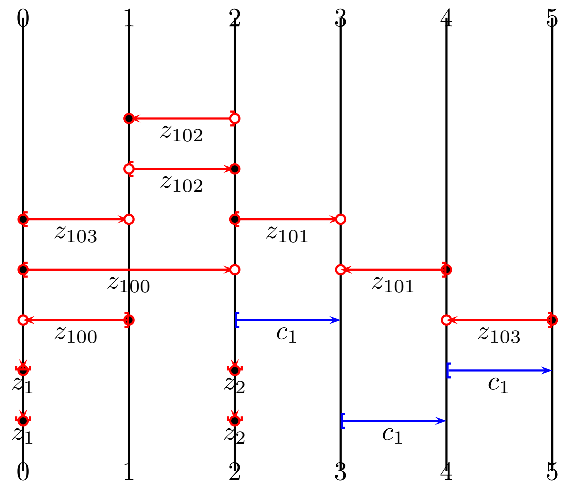
## Generalized Equation root-14.1.1

We begin from the GE root-14.1 (see pp. 63). We consider its print

```
Print 1: =0=2*<1=3*<2=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 4.
Step 2: Moved (old) base [0-2:z100+.] to (new) boundaries 2 - 4.
Step 3: Moved (old) base [1-2:z102+.] to (new) boundaries 3 - 4.
Step 4: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 3.
Step 5: Collapsed (new) base [2-4:z2+.] to the empty base (4,4).
Step 6: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 7: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-14.1.1—is illustrated below:




**GE Information**: Carrier: [0-2:z100+.] ; Carrier Dual: [0-1:z100-.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [0-2:z100+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z100-.] and its dual are of opposite polarity, yet intersect. The base [1-2:z102+.] and its dual are of opposite polarity, yet intersect. The base [1-2:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-14.1.1, as derived from the application of a print to root-14.1.

## Generalized Equation root-14.1.2

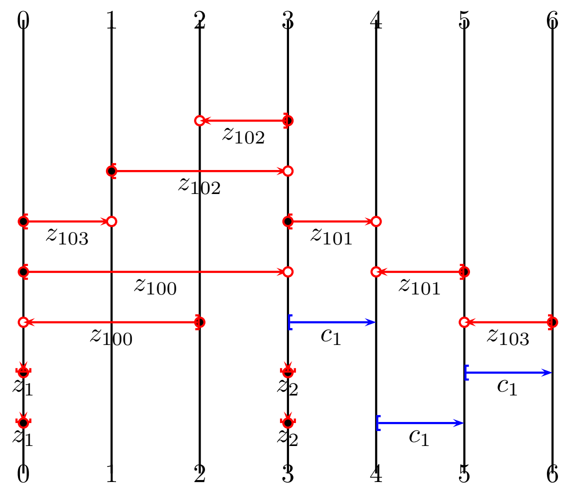
We begin from the GE root-14.1 (see pp. 63). We consider its print

```
Print 2: =0=2*<1<3*<2=4*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [0-2:z100+.] to (new) boundaries 2 - 5.
Step 4: Moved (old) base [1-2:z102+.] to (new) boundaries 3 - 5.
Step 5: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 3.
Step 6: Collapsed (new) base [2-5:z2+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This

will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-14.1.2—is illustrated below:




**GE Information**: Carrier: [0-3:z100+.] ; Carrier Dual: [0-2:z100-.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [0-3:z100+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z100-.] and its dual are of opposite polarity, yet intersect. The base [1-3:z102+.] and its dual are of opposite polarity, yet intersect. The base [2-3:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-14.1.2, as derived from the application of a print to root-14.1.

## Generalized Equation root-14.1.3

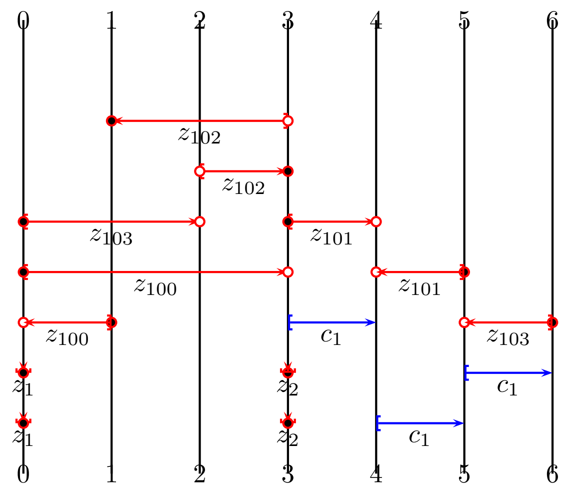
We begin from the GE root-14.1 (see pp. 63). We consider its print

```
Print 3: =0=2*<3*<1<2=4*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [0-2:z100+.] to (new) boundaries 2 - 5.
Step 4: Moved (old) base [1-2:z102+.] to (new) boundaries 4 - 5.
Step 5: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 4.

Step 6: Collapsed (new) base [2-5:z2+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

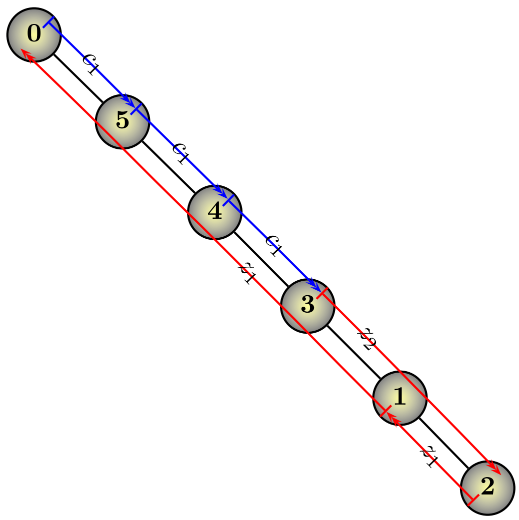
Upon applying the print, the GE we obtain—which we refer to as root-14.1.3—is illustrated below:




**GE Information**: Carrier: [0-3:z100+.] ; Carrier Dual: [0-1:z100-.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [0-3:z100+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z100-.] and its dual are of opposite polarity, yet intersect. The base [2-3:z102+.] and its dual are of opposite polarity, yet intersect. The base [1-3:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-14.1.3, as derived from the application of a print to root-14.1.

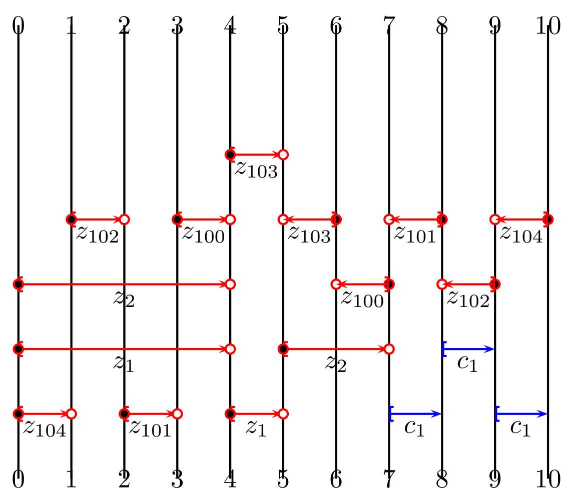
# 15 Cancellation scheme #15




| | |
|---|---|
| $z_1$ | $1 \leftarrow 3 \leftarrow 4 \leftarrow 5 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 1 \leftarrow 2$ |
| $c_1$ | $4 \leftarrow 3$ |
| $c_1$ | $5 \leftarrow 4$ |
| $c_1$ | $0 \leftarrow 5$ |

## Generalized Equation root-15

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-4:z1+.] ; Carrier Dual: [4-5:z1+.] ; Critical Boundary: 4; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=4*<1<2<3<4=5*
```

We proceed.

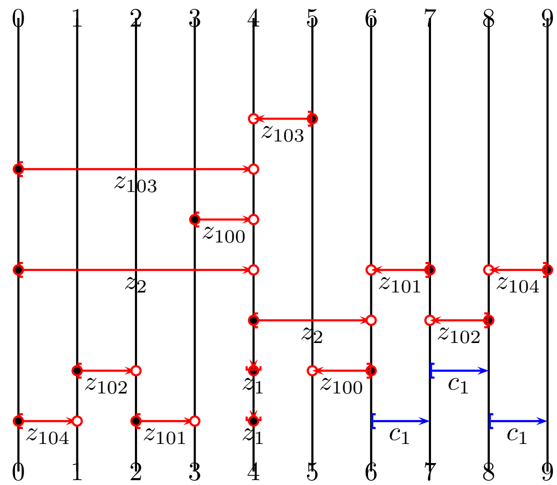
## Generalized Equation root-15.1

We begin from the GE root-15 (see pp. 68). We consider its print

```
Print 1: =0=4*<1<2<3<4=5*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Added (new) boundary 7.
Step 4: Moved (old) base [0-4:z1+.] to (new) boundaries 4 - 8.
Step 5: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 8.
Step 6: Moved (old) base [3-4:z100+.] to (new) boundaries 7 - 8.
Step 7: Moved (old) base [2-3:z101+.] to (new) boundaries 6 - 7.
Step 8: Moved (old) base [1-2:z102+.] to (new) boundaries 5 - 6.
Step 9: Moved (old) base [0-1:z104+.] to (new) boundaries 4 - 5.
Step 10: Collapsed (new) base [4-8:z1+.] to the empty base (8,8).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-15.1—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-6:z2+.] ; Critical Boundary: 4; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 7 valid prints (descendents).

It has 7 legal carrier-to-dual prints, as follows:

```
Print 1: =0=4*<1<2<3=5*<4=6*
Print 2: =0=4*<1<2<3<5*<4=6*
Print 3: =0=4*<1<2=5*<3<4=6*
Print 4: =0=4*<1<2<5*<3<4=6*
Print 5: =0=4*<1=5*<2<3<4=6*
Print 6: =0=4*<1<5*<2<3<4=6*
Print 7: =0=4*<5*<1<2<3<4=6*
```

This completes the consideration of root-15.1, as derived from the application of a print to root-15.

## Generalized Equation root-15.1.1

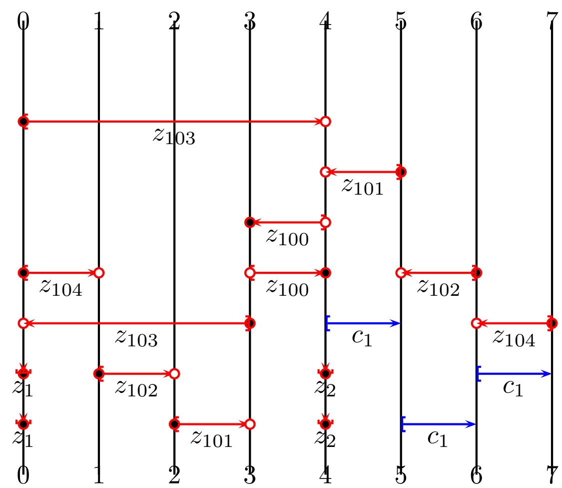
We begin from the GE root-15.1 (see pp. 69). We consider its print

```
Print 1: =0=4*<1<2<3=5*<4=6*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 8.
Step 4: Moved (old) base [3-4:z100+.] to (new) boundaries 7 - 8.
Step 5: Moved (old) base [2-3:z101+.] to (new) boundaries 6 - 7.

Step 6: Moved (old) base [1-2:z102+.] to (new) boundaries 5 - 6.
Step 7: Moved (old) base [0-4:z103+.] to (new) boundaries 4 - 8.
Step 8: Moved (old) base [0-1:z104+.] to (new) boundaries 4 - 5.
Step 9: Collapsed (new) base [4-8:z2+.] to the empty base (8,8).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-15.1.1—is illustrated below:




**GE Information**: Carrier: [0-4:z103+.] ; Carrier Dual: [0-3:z103-.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [3-4:z100+.] and its dual are of opposite polarity, yet intersect. The base [3-4:z100-.] and its dual are of opposite polarity, yet intersect. The base [0-4:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-15.1.1, as derived from the application of a print to root-15.1.

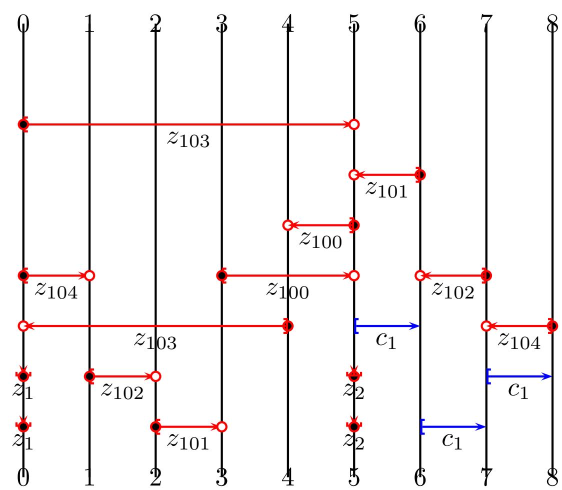
## Generalized Equation root-15.1.2

We begin from the GE root-15.1 (see pp. 69). We consider its print

```
Print 2: =0=4*<1<2<3<5*<4=6*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Added (new) boundary 7.
Step 4: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [3-4:z100+.] to (new) boundaries 7 - 9.
Step 6: Moved (old) base [2-3:z101+.] to (new) boundaries 6 - 7.
Step 7: Moved (old) base [1-2:z102+.] to (new) boundaries 5 - 6.
Step 8: Moved (old) base [0-4:z103+.] to (new) boundaries 4 - 9.
Step 9: Moved (old) base [0-1:z104+.] to (new) boundaries 4 - 5.
Step 10: Collapsed (new) base [4-9:z2+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-15.1.2—is illustrated below:




**GE Information**: Carrier: [0-5:z103+.] ; Carrier Dual: [0-4:z103-.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [3-5:z100+.]

and its dual are of opposite polarity, yet intersect. The base [4-5:z100-.] and its dual are of opposite polarity, yet intersect. The base [0-5:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-4:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-15.1.2, as derived from the application of a print to root-15.1.

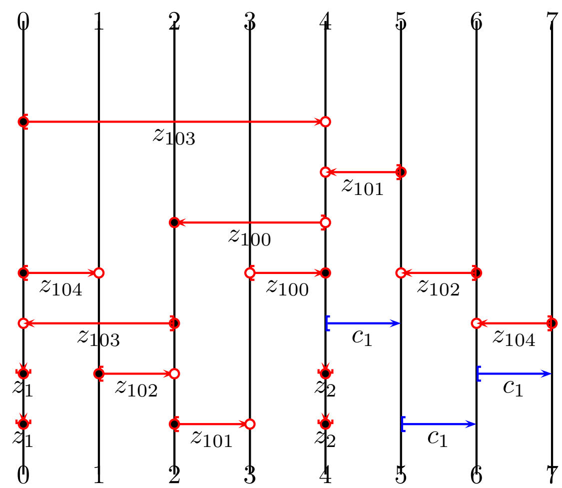
## Generalized Equation root-15.1.3

We begin from the GE root-15.1 (see pp. 69). We consider its print

```
Print 3: =0=4*<1<2=5*<3<4=6*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 8.
Step 4: Moved (old) base [3-4:z100+.] to (new) boundaries 7 - 8.
Step 5: Moved (old) base [2-3:z101+.] to (new) boundaries 6 - 7.
Step 6: Moved (old) base [1-2:z102+.] to (new) boundaries 5 - 6.
Step 7: Moved (old) base [0-4:z103+.] to (new) boundaries 4 - 8.
Step 8: Moved (old) base [0-1:z104+.] to (new) boundaries 4 - 5.
Step 9: Collapsed (new) base [4-8:z2+.] to the empty base (8,8).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-15.1.3—is illustrated below:




**GE Information**: Carrier: [0-4:z103+.] ; Carrier Dual: [0-2:z103-.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [3-4:z100+.] and its dual are of opposite polarity, yet intersect. The base [2-4:z100-.] and its dual are of opposite polarity, yet intersect. The base [0-4:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-15.1.3, as derived from the application of a print to root-15.1.

## Generalized Equation root-15.1.4

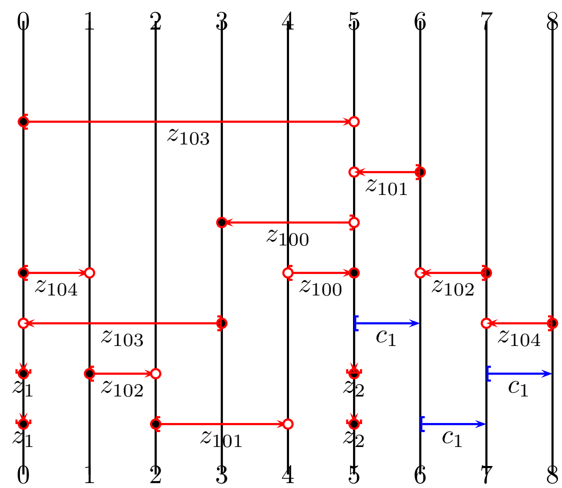
We begin from the GE root-15.1 (see pp. 69). We consider its print

```
Print 4: =0=4*<1<2<5*<3<4=6*
```

**Sequence of actions in performing the Print 4:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Added (new) boundary 8.
Step 4: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [3-4:z100+.] to (new) boundaries 8 - 9.
Step 6: Moved (old) base [2-3:z101+.] to (new) boundaries 6 - 8.
Step 7: Moved (old) base [1-2:z102+.] to (new) boundaries 5 - 6.
Step 8: Moved (old) base [0-4:z103+.] to (new) boundaries 4 - 9.
Step 9: Moved (old) base [0-1:z104+.] to (new) boundaries 4 - 5.

Step 10: Collapsed (new) base [4-9:z2+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-15.1.4—is illustrated below:




**GE Information**: Carrier: [0-5:z103+.] ; Carrier Dual: [0-3:z103-.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [4-5:z100+.] and its dual are of opposite polarity, yet intersect. The base [3-5:z100-.] and its dual are of opposite polarity, yet intersect. The base [0-5:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-15.1.4, as derived from the application of a print to root-15.1.

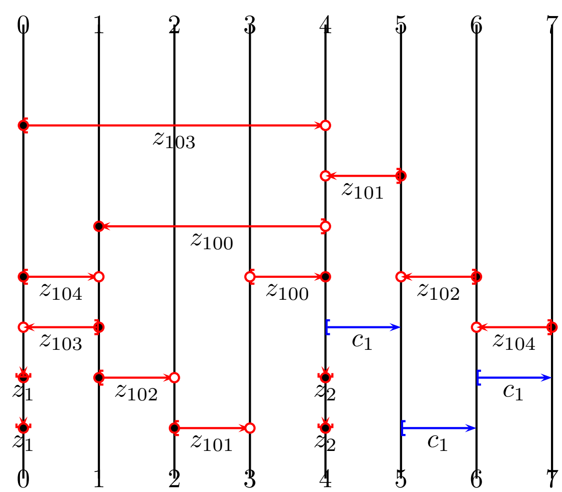
## Generalized Equation root-15.1.5

We begin from the GE root-15.1 (see pp. 69). We consider its print

```
Print 5: =0=4*<1=5*<2<3<4=6*
```

**Sequence of actions in performing the Print 5:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 8.
Step 4: Moved (old) base [3-4:z100+.] to (new) boundaries 7 - 8.
Step 5: Moved (old) base [2-3:z101+.] to (new) boundaries 6 - 7.
Step 6: Moved (old) base [1-2:z102+.] to (new) boundaries 5 - 6.
Step 7: Moved (old) base [0-4:z103+.] to (new) boundaries 4 - 8.
Step 8: Moved (old) base [0-1:z104+.] to (new) boundaries 4 - 5.
Step 9: Collapsed (new) base [4-8:z2+.] to the empty base (8,8).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-15.1.5—is illustrated below:




**GE Information**: Carrier: [0-4:z103+.] ; Carrier Dual: [0-1:z103-.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [3-4:z100+.] and its dual are of opposite polarity, yet intersect. The base [1-4:z100-.] and its dual are of opposite polarity, yet intersect. The base [0-4:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-15.1.5, as derived from the application of a print to root-15.1.

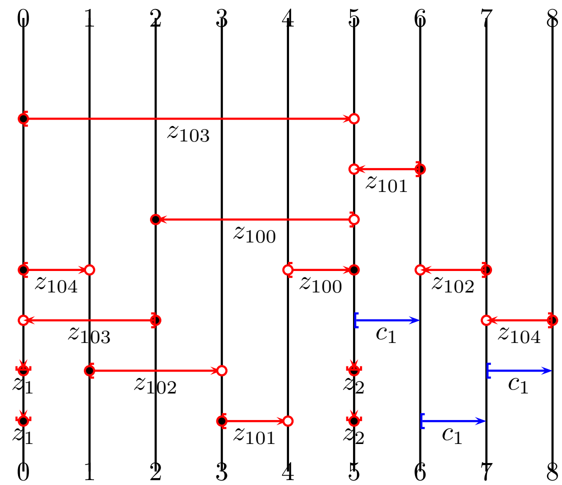
## Generalized Equation root-15.1.6

We begin from the GE root-15.1 (see pp. 69). We consider its print

```
Print 6: =0=4*<1<5*<2<3<4=6*
```

**Sequence of actions in performing the Print 6:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 7.
Step 3: Added (new) boundary 8.
Step 4: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [3-4:z100+.] to (new) boundaries 8 - 9.
Step 6: Moved (old) base [2-3:z101+.] to (new) boundaries 7 - 8.
Step 7: Moved (old) base [1-2:z102+.] to (new) boundaries 5 - 7.
Step 8: Moved (old) base [0-4:z103+.] to (new) boundaries 4 - 9.
Step 9: Moved (old) base [0-1:z104+.] to (new) boundaries 4 - 5.
Step 10: Collapsed (new) base [4-9:z2+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-15.1.6—is illustrated below:




**GE Information**: Carrier: [0-5:z103+.] ; Carrier Dual: [0-2:z103-.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [4-5:z100+.] and its dual are of opposite polarity, yet intersect. The base [2-5:z100-.] and its dual are of opposite polarity, yet intersect. The base [0-5:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-15.1.6, as derived from the application of a print to root-15.1.

## Generalized Equation root-15.1.7

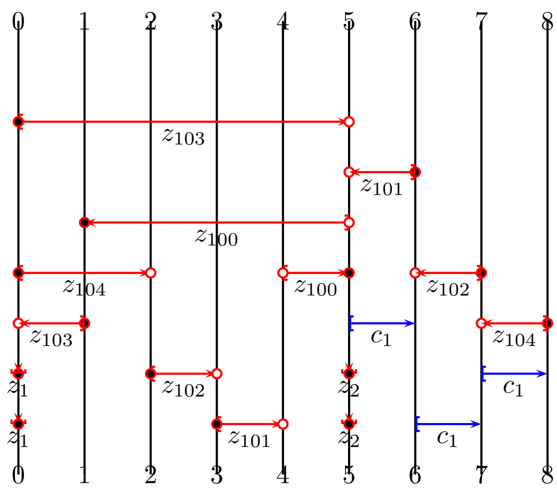
We begin from the GE root-15.1 (see pp. 69). We consider its print

```
Print 7: =0=4*<5*<1<2<3<4=6*
```

**Sequence of actions in performing the Print 7:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 7.
Step 3: Added (new) boundary 8.
Step 4: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [3-4:z100+.] to (new) boundaries 8 - 9.
Step 6: Moved (old) base [2-3:z101+.] to (new) boundaries 7 - 8.
Step 7: Moved (old) base [1-2:z102+.] to (new) boundaries 6 - 7.
Step 8: Moved (old) base [0-4:z103+.] to (new) boundaries 4 - 9.
Step 9: Moved (old) base [0-1:z104+.] to (new) boundaries 4 - 6.

Step 10: Collapsed (new) base [4-9:z2+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

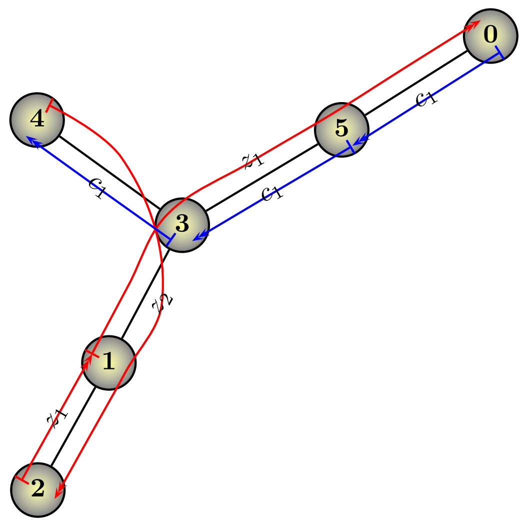
Upon applying the print, the GE we obtain—which we refer to as root-15.1.7—is illustrated below:




**GE Information**: Carrier: [0-5:z103+.] ; Carrier Dual: [0-1:z103-.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [4-5:z100+.] and its dual are of opposite polarity, yet intersect. The base [1-5:z100-.] and its dual are of opposite polarity, yet intersect. The base [0-5:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-15.1.7, as derived from the application of a print to root-15.1.

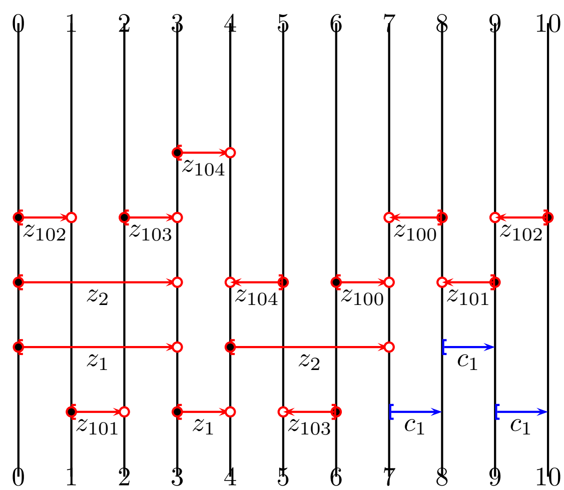
## 16 Cancellation scheme #16




| | |
|---|---|
| $z_1$ | $1 \leftarrow 3 \leftarrow 5 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $4 \leftarrow 3 \leftarrow 1 \leftarrow 2$ |
| $c_1$ | $3 \leftarrow 4$ |
| $c_1$ | $5 \leftarrow 3$ |
| $c_1$ | $0 \leftarrow 5$ |

### Generalized Equation root-16

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-3:z1+.] ; Carrier Dual: [3-4:z1+.] ; Critical Boundary: 3; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=3*<1<2<3=4*
```

We proceed.

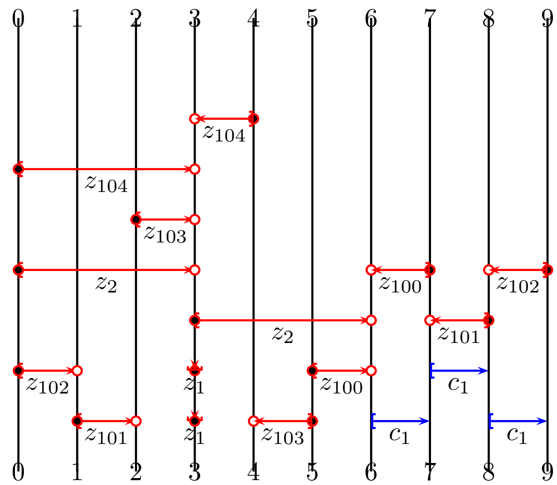
## Generalized Equation root-16.1

We begin from the GE root-16 (see pp. 80). We consider its print

```
Print 1: =0=3*<1<2<3=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 5.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 6.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 6.
Step 5: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 5.
Step 6: Moved (old) base [0-1:z102+.] to (new) boundaries 3 - 4.
Step 7: Moved (old) base [2-3:z103+.] to (new) boundaries 5 - 6.
Step 8: Collapsed (new) base [3-6:z1+.] to the empty base (6,6).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-16.1—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-6:z2+.] ; Critical Boundary: 3; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 10 valid prints (descendents).

It has 10 legal carrier-to-dual prints, as follows:

```
Print 1: =0=3*<1<2=4*<5*<3=6*
Print 2: =0=3*<1<2<4*<5*<3=6*
Print 3: =0=3*<1=4*<2<5*<3=6*
Print 4: =0=3*<1=4*<5*<2<3=6*
Print 5: =0=3*<1<4*<2<5*<3=6*
Print 6: =0=3*<1<4*<5*<2<3=6*
Print 7: =0=3*<4*<1<2<5*<3=6*
Print 8: =0=3*<4*<1=5*<2<3=6*
Print 9: =0=3*<4*<1<5*<2<3=6*
Print 10: =0=3*<4*<5*<1<2<3=6*
```

This completes the consideration of root-16.1, as derived from the application of a print to root-16.

## Generalized Equation root-16.1.1

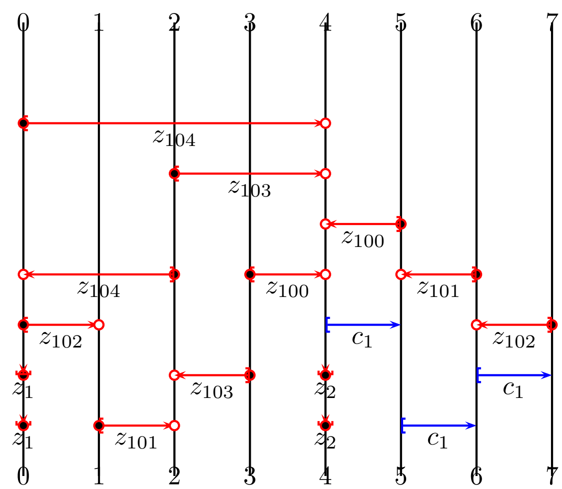
We begin from the GE root-16.1 (see pp. 81). We consider its print

```
Print 1: =0=3*<1<2=4*<5*<3=6*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.

Step 3: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 5.
Step 4: Moved (old) base [0-1:z102+.] to (new) boundaries 3 - 4.
Step 5: Moved (old) base [2-3:z103+.] to (new) boundaries 5 - 7.
Step 6: Moved (old) base [0-3:z104+.] to (new) boundaries 3 - 7.
Step 7: Collapsed (new) base [3-7:z2+.] to the empty base (7,7).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-16.1.1—is illustrated below:




**GE Information**: Carrier: [0-4:z104+.] ; Carrier Dual: [0-2:z104-.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [2-4:z103+.] and its dual are of opposite polarity, yet intersect. The base [2-3:z103-.] and its dual are of opposite polarity, yet intersect. The base [0-4:z104+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-16.1.1, as derived from the application of a print to root-16.1.

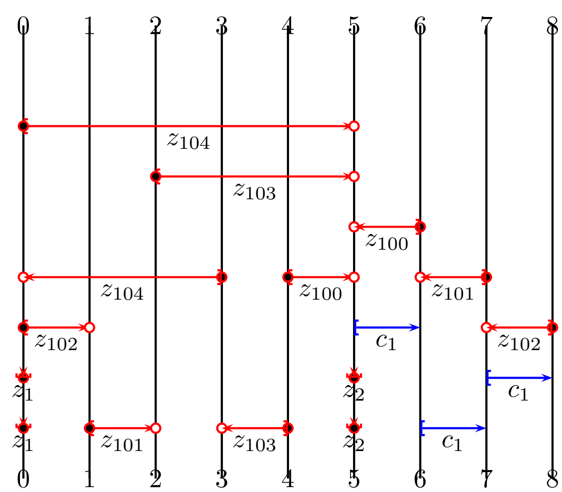
## Generalized Equation root-16.1.2

We begin from the GE root-16.1 (see pp. 81). We consider its print

```
Print 2: =0=3*<1<2<4*<5*<3=6*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 5.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 5.
Step 5: Moved (old) base [0-1:z102+.] to (new) boundaries 3 - 4.
Step 6: Moved (old) base [2-3:z103+.] to (new) boundaries 5 - 8.
Step 7: Moved (old) base [0-3:z104+.] to (new) boundaries 3 - 8.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-16.1.2—is illustrated below:




**GE Information**: Carrier: [0-5:z104+.] ; Carrier Dual: [0-3:z104-.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [2-5:z103+.] and its dual are of opposite polarity, yet intersect. The base [3-4:z103-.] and its dual are of opposite polarity, yet intersect. The base [0-5:z104+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-16.1.2, as derived from the application of a print to root-16.1.

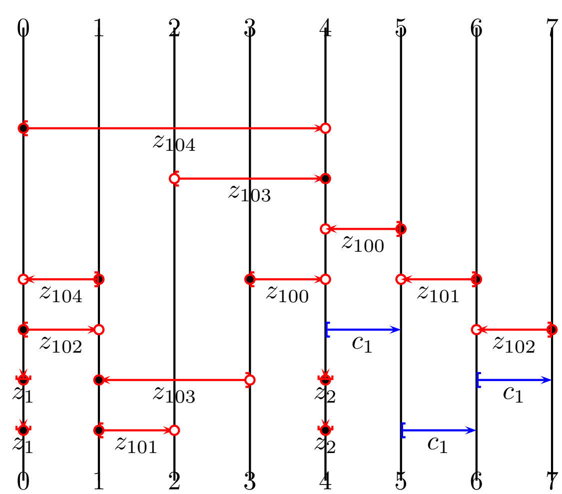
## Generalized Equation root-16.1.3

We begin from the GE root-16.1 (see pp. 81). We consider its print

```
Print 3: =0=3*<1=4*<2<5*<3=6*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 5.
Step 2: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 3: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 5.
Step 4: Moved (old) base [0-1:z102+.] to (new) boundaries 3 - 4.
Step 5: Moved (old) base [2-3:z103+.] to (new) boundaries 5 - 7.
Step 6: Moved (old) base [0-3:z104+.] to (new) boundaries 3 - 7.
Step 7: Collapsed (new) base [3-7:z2+.] to the empty base (7,7).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-16.1.3—is illustrated below:



**GE Information**: Carrier: [0-4:z104+.] ; Carrier Dual: [0-1:z104-.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [2-4:z103+.] and its dual are of opposite polarity, yet intersect. The base [1-3:z103-.] and its dual are of opposite polarity, yet intersect. The base [0-4:z104+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-16.1.3, as derived from the application of a print to root-16.1.

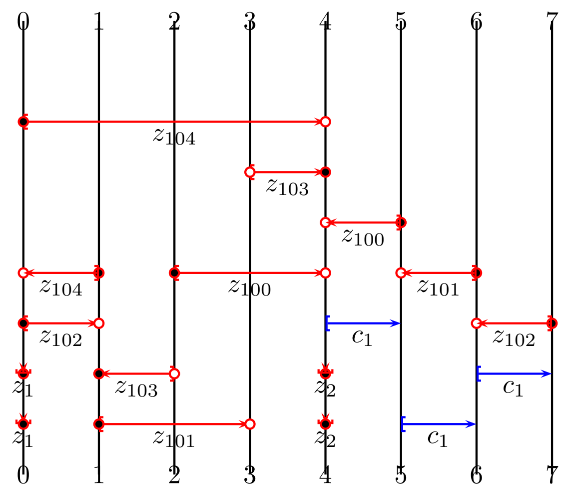
## Generalized Equation root-16.1.4

We begin from the GE root-16.1 (see pp. 81). We consider its print

```
Print 4: =0=3*<1=4*<5*<2<3=6*
```

**Sequence of actions in performing the Print 4:**
Step 1: Added (new) boundary 6.
Step 2: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 3: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 6.
Step 4: Moved (old) base [0-1:z102+.] to (new) boundaries 3 - 4.
Step 5: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 7.
Step 6: Moved (old) base [0-3:z104+.] to (new) boundaries 3 - 7.
Step 7: Collapsed (new) base [3-7:z2+.] to the empty base (7,7).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-16.1.4—is illustrated below:




**GE Information**: Carrier: [0-4:z104+.] ; Carrier Dual: [0-1:z104-.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [0-4:z104+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-16.1.4, as derived from the application of a print to root-16.1.

## Generalized Equation root-16.1.5

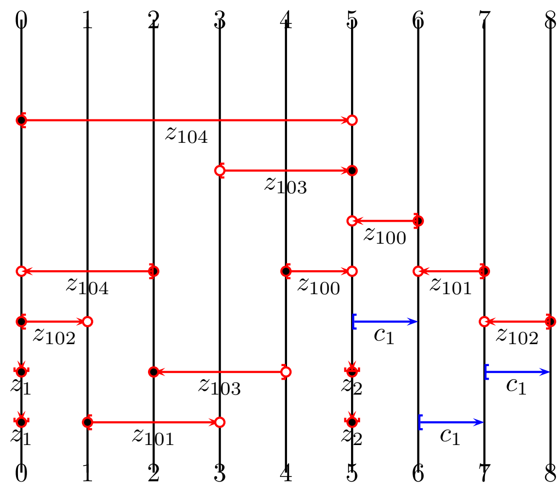
We begin from the GE root-16.1 (see pp. 81). We consider its print

```
Print 5: =0=3*<1<4*<2<5*<3=6*
```

**Sequence of actions in performing the Print 5:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 6.
Step 5: Moved (old) base [0-1:z102+.] to (new) boundaries 3 - 4.
Step 6: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 8.
Step 7: Moved (old) base [0-3:z104+.] to (new) boundaries 3 - 8.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This

will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-16.1.5—is illustrated below:




**GE Information**: Carrier: [0-5:z104+.] ; Carrier Dual: [0-2:z104-.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [3-5:z103+.] and its dual are of opposite polarity, yet intersect. The base [2-4:z103-.] and its dual are of opposite polarity, yet intersect. The base [0-5:z104+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-16.1.5, as derived from the application of a print to root-16.1.

## Generalized Equation root-16.1.6

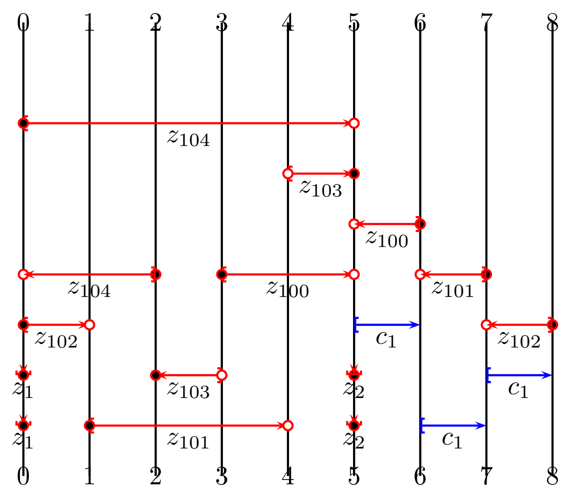
We begin from the GE root-16.1 (see pp. 81). We consider its print

```
Print 6: =0=3*<1<4*<5*<2<3=6*
```

**Sequence of actions in performing the Print 6:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.

Step 4: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 7.
Step 5: Moved (old) base [0-1:z102+.] to (new) boundaries 3 - 4.
Step 6: Moved (old) base [2-3:z103+.] to (new) boundaries 7 - 8.
Step 7: Moved (old) base [0-3:z104+.] to (new) boundaries 3 - 8.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-16.1.6—is illustrated below:




**GE Information**: Carrier: [0-5:z104+.] ; Carrier Dual: [0-2:z104-.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [0-5:z104+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-16.1.6, as derived from the application of a print to root-16.1.

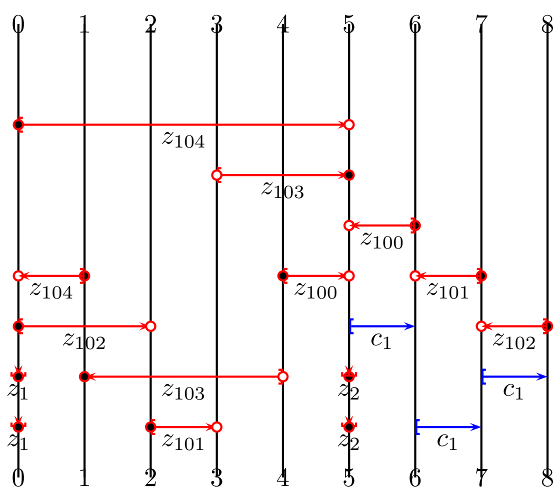
## Generalized Equation root-16.1.7

We begin from the GE root-16.1 (see pp. 81). We consider its print

```
Print 7: =0=3*<4*<1<2<5*<3=6*
```

**Sequence of actions in performing the Print 7:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [1-2:z101+.] to (new) boundaries 5 - 6.
Step 5: Moved (old) base [0-1:z102+.] to (new) boundaries 3 - 5.
Step 6: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 8.
Step 7: Moved (old) base [0-3:z104+.] to (new) boundaries 3 - 8.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-16.1.7—is illustrated below:




**GE Information**: Carrier: [0-5:z104+.] ; Carrier Dual: [0-1:z104-.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [3-5:z103+.] and its dual are of opposite polarity, yet intersect. The base [1-4:z103-.] and its dual are of opposite polarity, yet intersect. The base [0-5:z104+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-16.1.7, as derived from the application of a print to root-16.1.

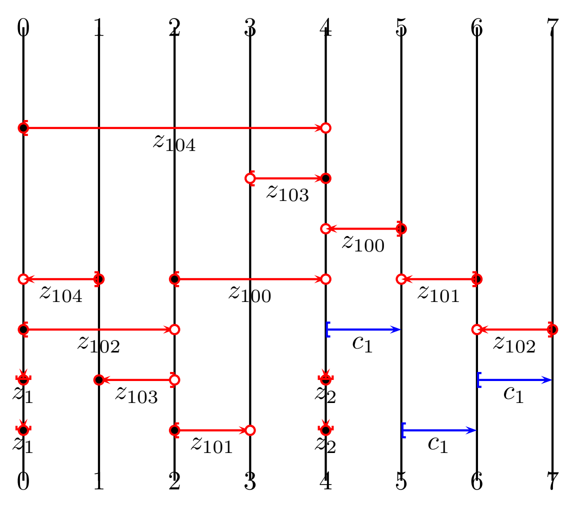
## Generalized Equation root-16.1.8

We begin from the GE root-16.1 (see pp. 81). We consider its print

```
Print 8: =0=3*<4*<1=5*<2<3=6*
```

**Sequence of actions in performing the Print 8:**
Step 1: Added (new) boundary 6.
Step 2: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 3: Moved (old) base [1-2:z101+.] to (new) boundaries 5 - 6.
Step 4: Moved (old) base [0-1:z102+.] to (new) boundaries 3 - 5.
Step 5: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 7.
Step 6: Moved (old) base [0-3:z104+.] to (new) boundaries 3 - 7.
Step 7: Collapsed (new) base [3-7:z2+.] to the empty base (7,7).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-16.1.8—is illustrated below:




**GE Information**: Carrier: [0-4:z104+.] ; Carrier Dual: [0-1:z104-.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [0-4:z104+.]

and its dual are of opposite polarity, yet intersect. The base [0-1:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-16.1.8, as derived from the application of a print to root-16.1.

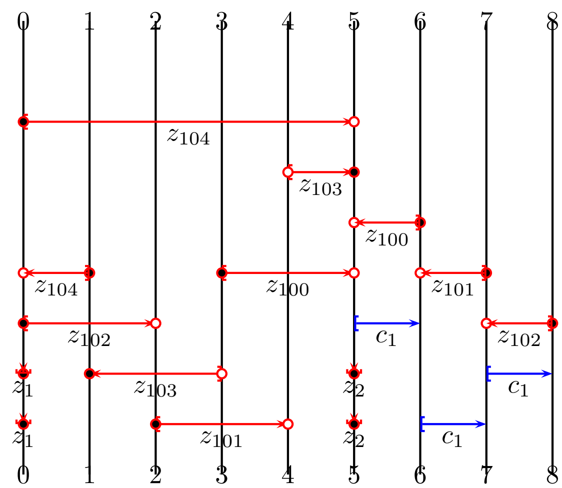
## Generalized Equation root-16.1.9

We begin from the GE root-16.1 (see pp. 81). We consider its print

```
Print 9: =0=3*<4*<1<5*<2<3=6*
```

**Sequence of actions in performing the Print 9:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [1-2:z101+.] to (new) boundaries 5 - 7.
Step 5: Moved (old) base [0-1:z102+.] to (new) boundaries 3 - 5.
Step 6: Moved (old) base [2-3:z103+.] to (new) boundaries 7 - 8.
Step 7: Moved (old) base [0-3:z104+.] to (new) boundaries 3 - 8.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-16.1.9—is illustrated below:




**GE Information**: Carrier: [0-5:z104+.] ; Carrier Dual: [0-1:z104-.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [0-5:z104+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-16.1.9, as derived from the application of a print to root-16.1.

## Generalized Equation root-16.1.10

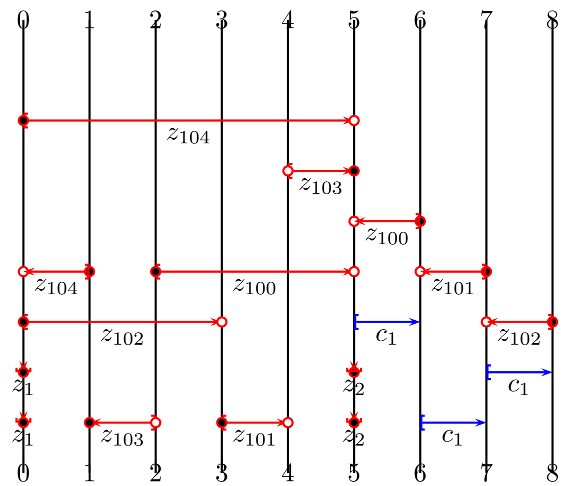
We begin from the GE root-16.1 (see pp. 81). We consider its print

```
Print 10: =0=3*<4*<5*<1<2<3=6*
```

**Sequence of actions in performing the Print 10:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [1-2:z101+.] to (new) boundaries 6 - 7.
Step 5: Moved (old) base [0-1:z102+.] to (new) boundaries 3 - 6.
Step 6: Moved (old) base [2-3:z103+.] to (new) boundaries 7 - 8.
Step 7: Moved (old) base [0-3:z104+.] to (new) boundaries 3 - 8.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This

will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

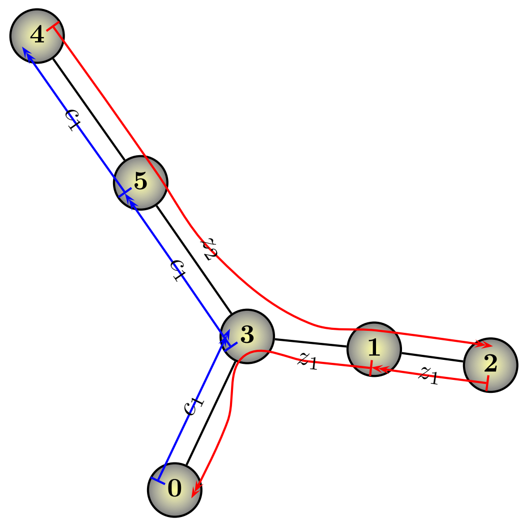
Upon applying the print, the GE we obtain—which we refer to as root-16.1.10—is illustrated below:




**GE Information**: Carrier: [0-5:z104+.] ; Carrier Dual: [0-1:z104-.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [0-5:z104+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-16.1.10, as derived from the application of a print to root-16.1.

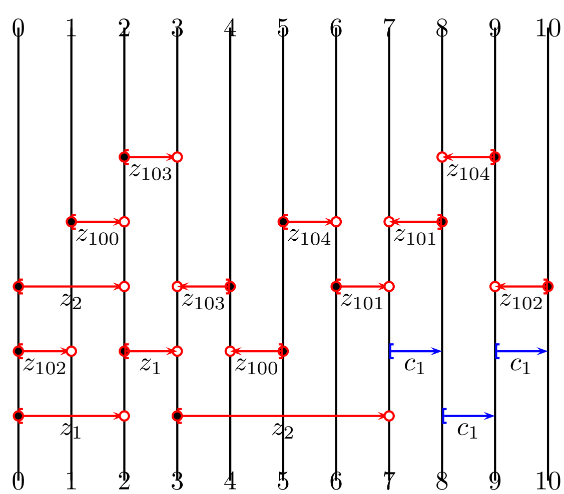
# 17 Cancellation scheme #17



| | |
|---|---|
| $z_1$ | $1 \leftarrow 3 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $4 \leftarrow 5 \leftarrow 3 \leftarrow 1 \leftarrow 2$ |
| $c_1$ | $5 \leftarrow 4$ |
| $c_1$ | $3 \leftarrow 5$ |
| $c_1$ | $0 \leftarrow 3$ |

## Generalized Equation root-17

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-2:z1+.] ; Carrier Dual: [2-3:z1+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1<2=3*
```

We proceed.

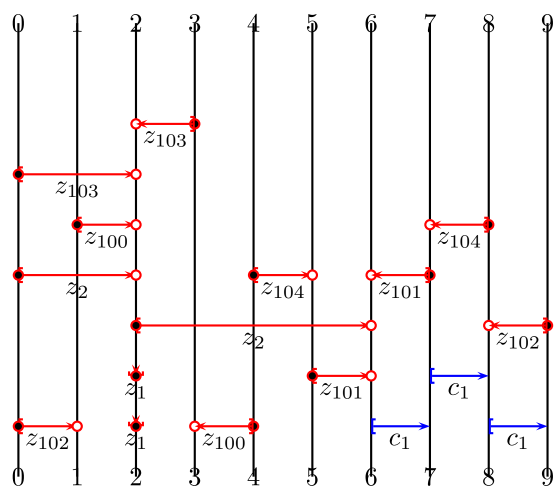
## Generalized Equation root-17.1

We begin from the GE root-17 (see pp. 95). We consider its print

```
Print 1: =0=2*<1<2=3*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 4.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 4.
Step 4: Moved (old) base [1-2:z100+.] to (new) boundaries 3 - 4.
Step 5: Moved (old) base [0-1:z102+.] to (new) boundaries 2 - 3.
Step 6: Collapsed (new) base [2-4:z1+.] to the empty base (4,4).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-17.1—is illustrated below:



**GE Information**: Carrier: [0-2:z2+.] ; Carrier Dual: [2-6:z2+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 6 valid prints (descendents).

It has 6 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1=3*<4*<5*<2=6*
Print 2: =0=2*<1<3*<4*<5*<2=6*
Print 3: =0=2*<3*<1<4*<5*<2=6*
Print 4: =0=2*<3*<4*<1=5*<2=6*
Print 5: =0=2*<3*<4*<1<5*<2=6*
Print 6: =0=2*<3*<4*<5*<1<2=6*
```

This completes the consideration of root-17.1, as derived from the application of a print to root-17.

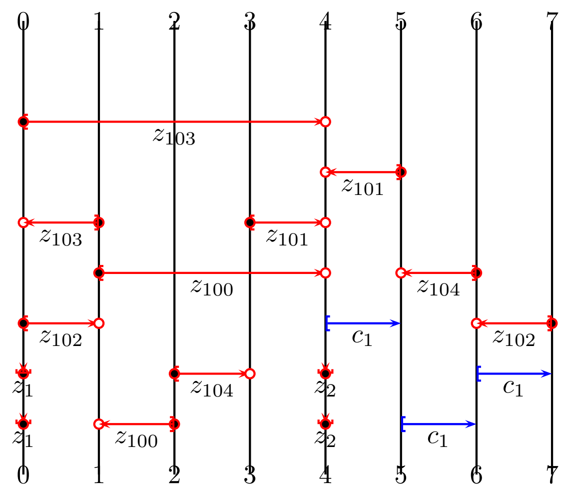
## Generalized Equation root-17.1.1

We begin from the GE root-17.1 (see pp. 96). We consider its print

```
Print 1: =0=2*<1=3*<4*<5*<2=6*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 6.
Step 2: Moved (old) base [1-2:z100+.] to (new) boundaries 3 - 6.
Step 3: Moved (old) base [0-1:z102+.] to (new) boundaries 2 - 3.
Step 4: Moved (old) base [0-2:z103+.] to (new) boundaries 2 - 6.
Step 5: Collapsed (new) base [2-6:z2+.] to the empty base (6,6).
Step 6: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 7: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-17.1.1—is illustrated below:




**GE Information**: Carrier: [0-4:z103+.] ; Carrier Dual: [0-1:z103-.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [1-4:z100+.] and its dual are of opposite polarity, yet intersect. The base [1-2:z100-.] and its dual are of opposite polarity, yet intersect. The base [0-4:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-17.1.1, as derived from the application of a print to root-17.1.

## Generalized Equation root-17.1.2

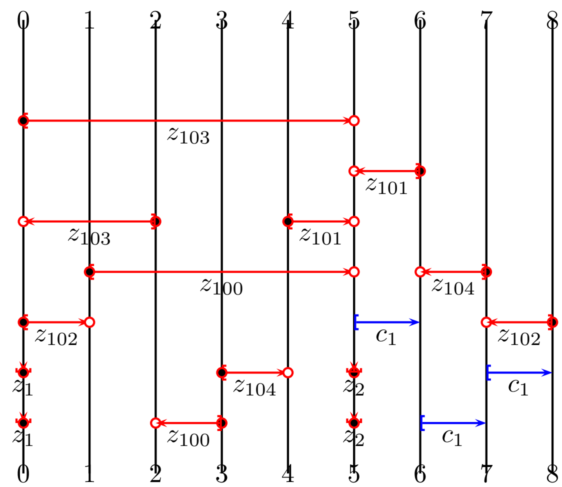
We begin from the GE root-17.1 (see pp. 96). We consider its print

```
Print 2: =0=2*<1<3*<4*<5*<2=6*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 7.
Step 3: Moved (old) base [1-2:z100+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [0-1:z102+.] to (new) boundaries 2 - 3.
Step 5: Moved (old) base [0-2:z103+.] to (new) boundaries 2 - 7.
Step 6: Collapsed (new) base [2-7:z2+.] to the empty base (7,7).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This

will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-17.1.2—is illustrated below:




**GE Information**: Carrier: [0-5:z103+.] ; Carrier Dual: [0-2:z103-.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [1-5:z100+.] and its dual are of opposite polarity, yet intersect. The base [2-3:z100-.] and its dual are of opposite polarity, yet intersect. The base [0-5:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-17.1.2, as derived from the application of a print to root-17.1.

## Generalized Equation root-17.1.3

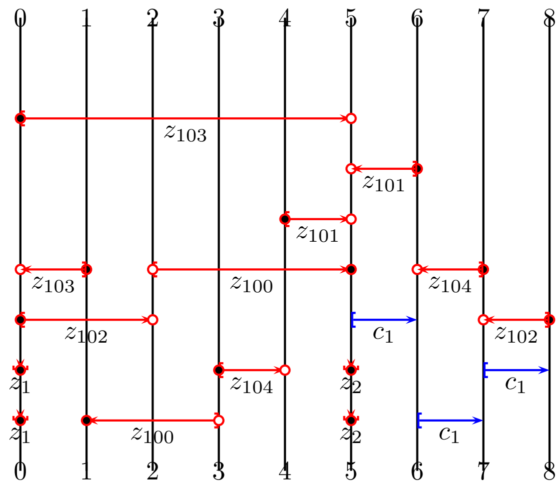
We begin from the GE root-17.1 (see pp. 96). We consider its print

```
Print 3: =0=2*<3*<1<4*<5*<2=6*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 7.
Step 3: Moved (old) base [1-2:z100+.] to (new) boundaries 4 - 7.
Step 4: Moved (old) base [0-1:z102+.] to (new) boundaries 2 - 4.
Step 5: Moved (old) base [0-2:z103+.] to (new) boundaries 2 - 7.

Step 6: Collapsed (new) base [2-7:z2+.] to the empty base (7,7).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-17.1.3—is illustrated below:




**GE Information**: Carrier: [0-5:z103+.] ; Carrier Dual: [0-1:z103-.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [2-5:z100+.] and its dual are of opposite polarity, yet intersect. The base [1-3:z100-.] and its dual are of opposite polarity, yet intersect. The base [0-5:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-17.1.3, as derived from the application of a print to root-17.1.

## Generalized Equation root-17.1.4

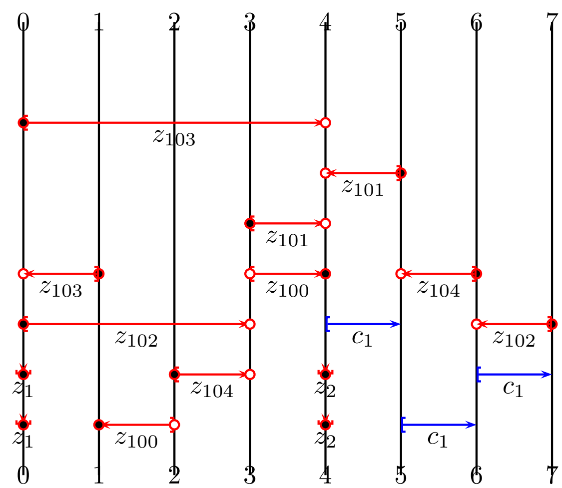
We begin from the GE root-17.1 (see pp. 96). We consider its print

```
Print 4: =0=2*<3*<4*<1=5*<2=6*
```

**Sequence of actions in performing the Print 4:**
Step 1: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 6.

Step 2: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 6.
Step 3: Moved (old) base [0-1:z102+.] to (new) boundaries 2 - 5.
Step 4: Moved (old) base [0-2:z103+.] to (new) boundaries 2 - 6.
Step 5: Collapsed (new) base [2-6:z2+.] to the empty base (6,6).
Step 6: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 7: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-17.1.4—is illustrated below:




**GE Information**: Carrier: [0-4:z103+.] ; Carrier Dual: [0-1:z103-.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [0-4:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-17.1.4, as derived from the application of a print to root-17.1.

## Generalized Equation root-17.1.5

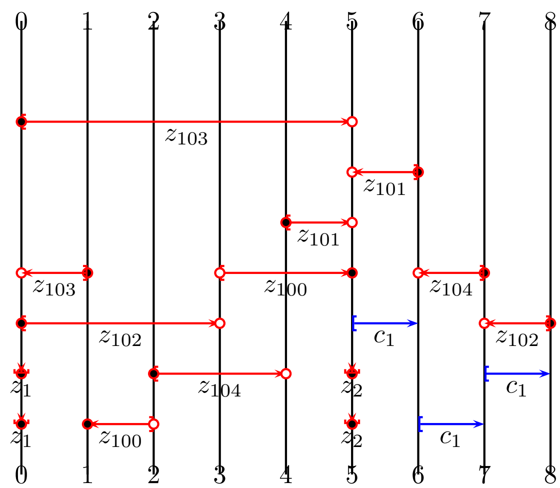
We begin from the GE root-17.1 (see pp. 96). We consider its print

```
Print 5: =0=2*<3*<4*<1<5*<2=6*
```

**Sequence of actions in performing the Print 5:**
Step 1: Added (new) boundary 5.

Step 2: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 7.
Step 3: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 7.
Step 4: Moved (old) base [0-1:z102+.] to (new) boundaries 2 - 5.
Step 5: Moved (old) base [0-2:z103+.] to (new) boundaries 2 - 7.
Step 6: Collapsed (new) base [2-7:z2+.] to the empty base (7,7).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-17.1.5—is illustrated below:




**GE Information**: Carrier: [0-5:z103+.] ; Carrier Dual: [0-1:z103-.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [0-5:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-17.1.5, as derived from the application of a print to root-17.1.

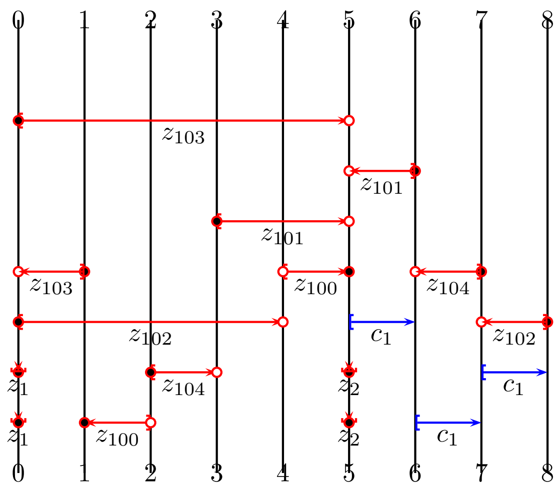
## Generalized Equation root-17.1.6

We begin from the GE root-17.1 (see pp. 96). We consider its print

```
Print 6: =0=2*<3*<4*<5*<1<2=6*
```

**Sequence of actions in performing the Print 6:**
Step 1: Added (new) boundary 6.
Step 2: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 7.
Step 3: Moved (old) base [1-2:z100+.] to (new) boundaries 6 - 7.
Step 4: Moved (old) base [0-1:z102+.] to (new) boundaries 2 - 6.
Step 5: Moved (old) base [0-2:z103+.] to (new) boundaries 2 - 7.
Step 6: Collapsed (new) base [2-7:z2+.] to the empty base (7,7).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

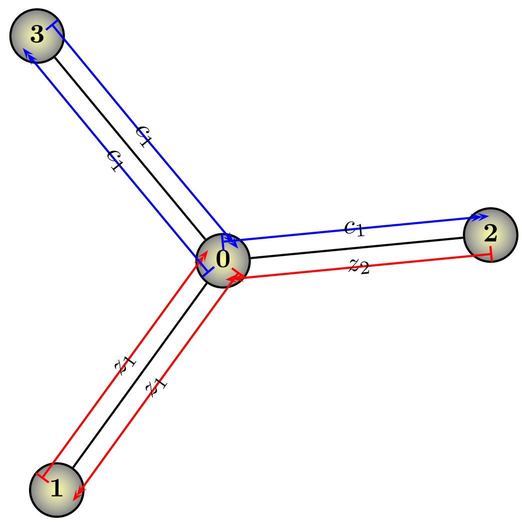
Upon applying the print, the GE we obtain—which we refer to as root-17.1.6—is illustrated below:




**GE Information**: Carrier: [0-5:z103+.] ; Carrier Dual: [0-1:z103-.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [0-5:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-1:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-17.1.6, as derived from the application of a print to root-17.1.

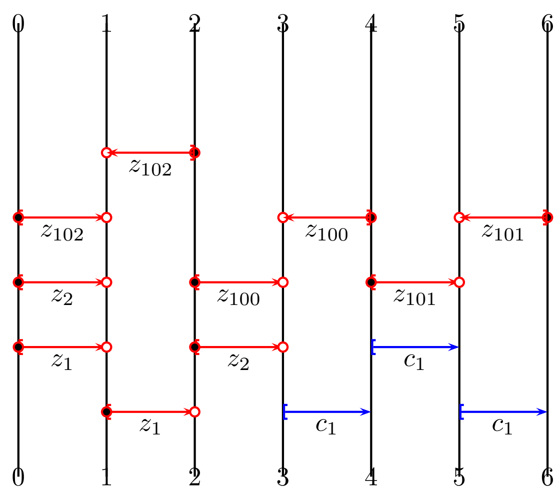
# 18 Cancellation scheme #18




| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $0 \leftarrow 1$ |
| $z_2$ | $2 \leftarrow 0$ |
| $c_1$ | $0 \leftarrow 2$ |
| $c_1$ | $3 \leftarrow 0$ |
| $c_1$ | $0 \leftarrow 3$ |

## Generalized Equation root-18

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-2:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<1=2*
```

We proceed.

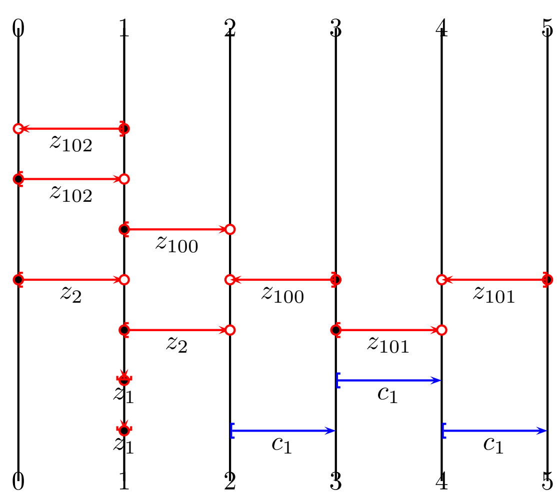
## Generalized Equation root-18.1

We begin from the GE root-18 (see pp. 104). We consider its print

```
Print 1: =0=1*<1=2*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 2.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 2.
Step 3: Moved (old) base [0-1:z102+.] to (new) boundaries 1 - 2.
Step 4: Collapsed (new) base [1-2:z1+.] to the empty base (2,2).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-18.1—is illustrated below:

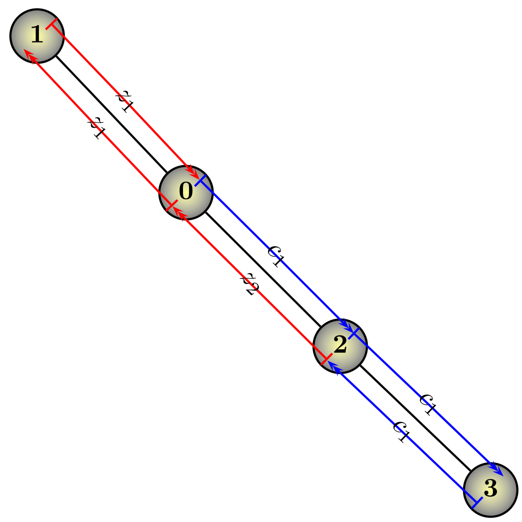



**GE Information**: Carrier: [0-1:z2+.] ; Carrier Dual: [1-2:z2+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [0-1:z102+.]

and its dual are of opposite polarity, yet intersect. The base [0-1:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-18.1, as derived from the application of a print to root-18.

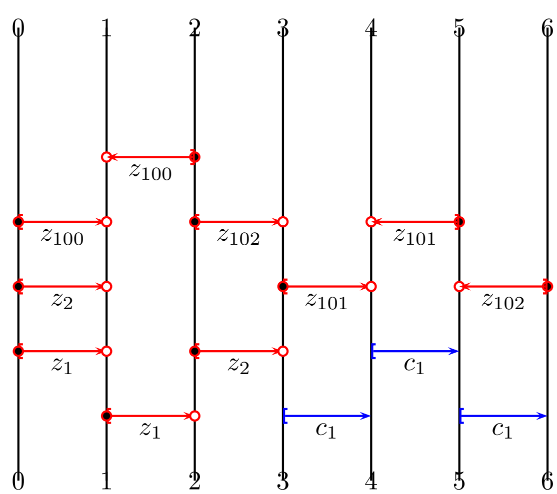
# 19 Cancellation scheme #19




| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $0 \leftarrow 1$ |
| $z_2$ | $2 \leftarrow 0$ |
| $c_1$ | $3 \leftarrow 2$ |
| $c_1$ | $2 \leftarrow 3$ |
| $c_1$ | $0 \leftarrow 2$ |

### Generalized Equation root-19

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-2:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<1=2*
```

We proceed.

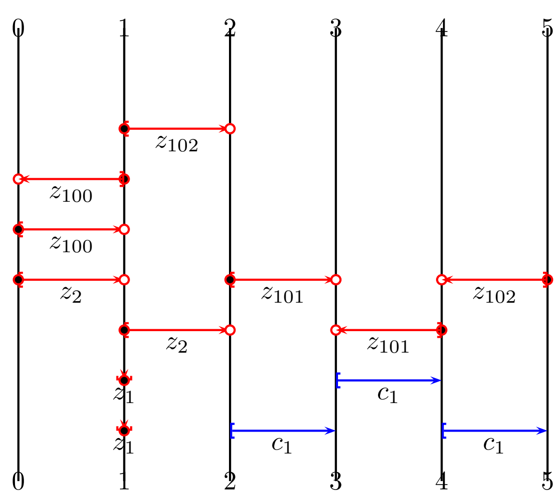
## Generalized Equation root-19.1

We begin from the GE root-19 (see pp. 107). We consider its print

```
Print 1: =0=1*<1=2*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 2.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 2.
Step 3: Moved (old) base [0-1:z100+.] to (new) boundaries 1 - 2.
Step 4: Collapsed (new) base [1-2:z1+.] to the empty base (2,2).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-19.1—is illustrated below:

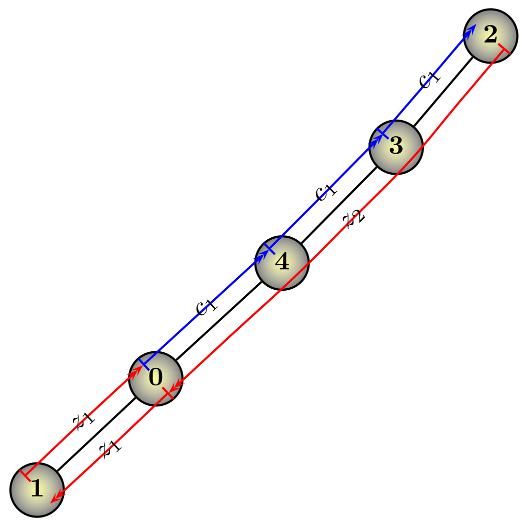



**GE Information**: Carrier: [0-1:z2+.] ; Carrier Dual: [1-2:z2+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [0-1:z100+.]

and its dual are of opposite polarity, yet intersect. The base [0-1:z100-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-19.1, as derived from the application of a print to root-19.

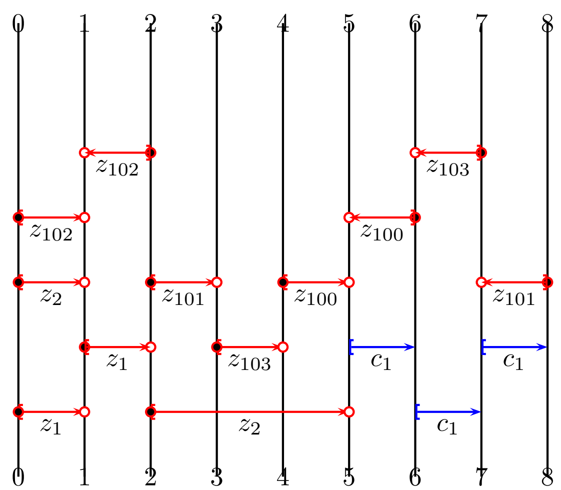
# 20 Cancellation scheme #20




| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $0 \leftarrow 1$ |
| $z_2$ | $2 \leftarrow 3 \leftarrow 4 \leftarrow 0$ |
| $c_1$ | $3 \leftarrow 2$ |
| $c_1$ | $4 \leftarrow 3$ |
| $c_1$ | $0 \leftarrow 4$ |

## Generalized Equation root-20

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-2:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<1=2*
```

We proceed.

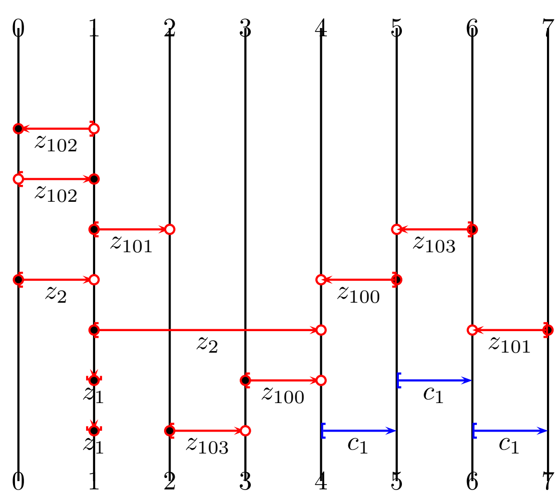
## Generalized Equation root-20.1

We begin from the GE root-20 (see pp. 110). We consider its print

```
Print 1: =0=1*<1=2*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 2.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 2.
Step 3: Moved (old) base [0-1:z102+.] to (new) boundaries 1 - 2.
Step 4: Collapsed (new) base [1-2:z1+.] to the empty base (2,2).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-20.1—is illustrated below:

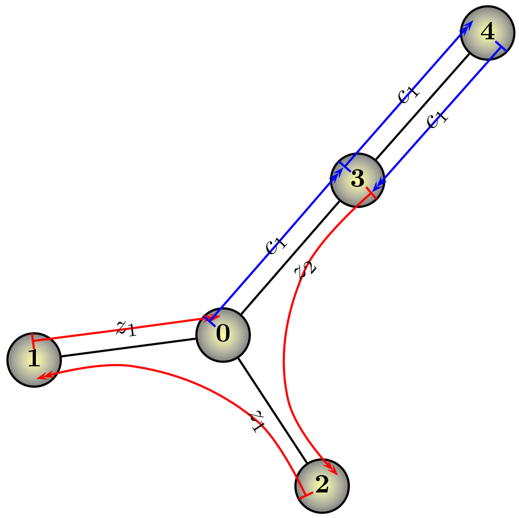



**GE Information**: Carrier: [0-1:z2+.] ; Carrier Dual: [1-4:z2+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [0-1:z102+.]

and its dual are of opposite polarity, yet intersect. The base [0-1:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-20.1, as derived from the application of a print to root-20.

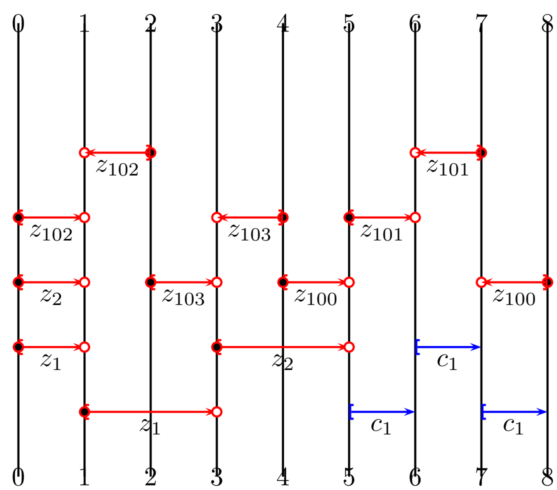
# 21 Cancellation scheme #21




| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 0 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 0 \leftarrow 2$ |
| $c_1$ | $4 \leftarrow 3$ |
| $c_1$ | $3 \leftarrow 4$ |
| $c_1$ | $0 \leftarrow 3$ |

## Generalized Equation root-21

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-3:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<2*<1=3*
```

We proceed.

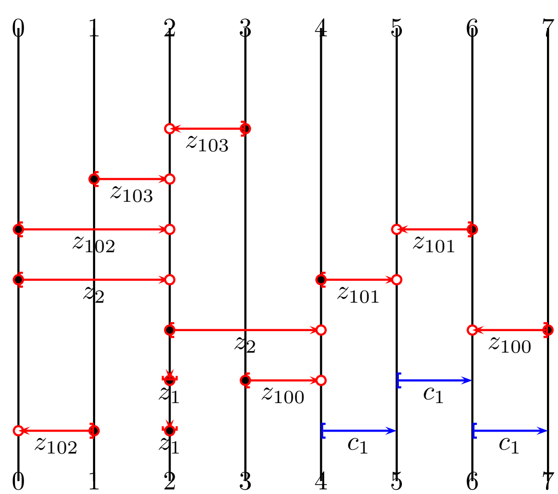
## Generalized Equation root-21.1

We begin from the GE root-21 (see pp. 113). We consider its print

```
Print 1: =0=1*<2*<1=3*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 3.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 3.
Step 3: Moved (old) base [0-1:z102+.] to (new) boundaries 1 - 3.
Step 4: Collapsed (new) base [1-3:z1+.] to the empty base (3,3).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-21.1—is illustrated below:

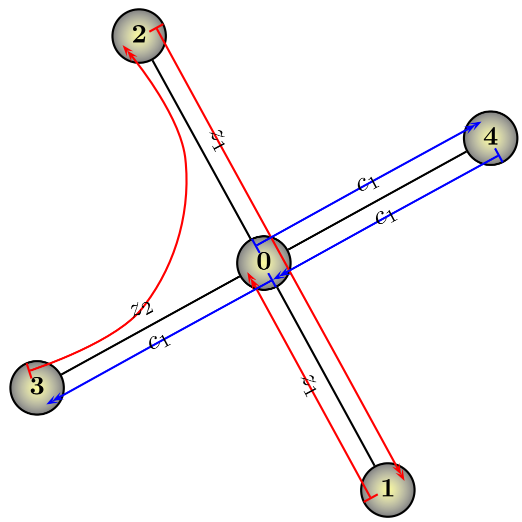



**GE Information**: Carrier: [0-2:z2+.] ; Carrier Dual: [2-4:z2+.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [0-2:z102+.]

and its dual are of opposite polarity, yet intersect. The base [0-1:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-21.1, as derived from the application of a print to root-21.

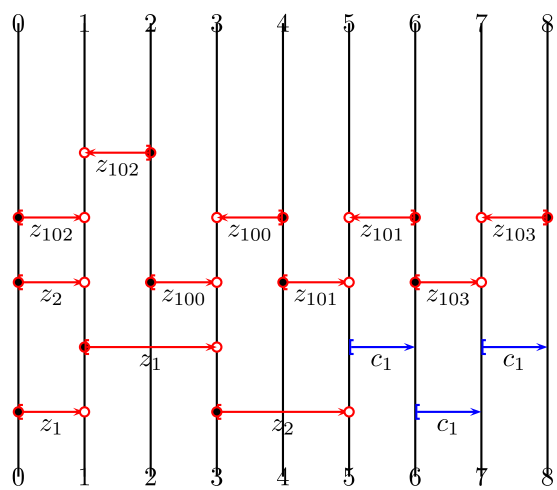
# 22 Cancellation scheme #22




| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 0 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 0 \leftarrow 2$ |
| $c_1$ | $0 \leftarrow 3$ |
| $c_1$ | $4 \leftarrow 0$ |
| $c_1$ | $0 \leftarrow 4$ |

## Generalized Equation root-22

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-3:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<2*<1=3*
```

We proceed.

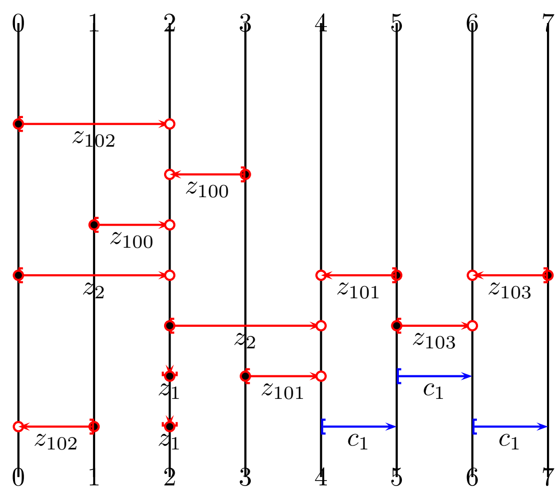
## Generalized Equation root-22.1

We begin from the GE root-22 (see pp. 116). We consider its print

```
Print 1: =0=1*<2*<1=3*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 3.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 3.
Step 3: Moved (old) base [0-1:z102+.] to (new) boundaries 1 - 3.
Step 4: Collapsed (new) base [1-3:z1+.] to the empty base (3,3).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-22.1—is illustrated below:

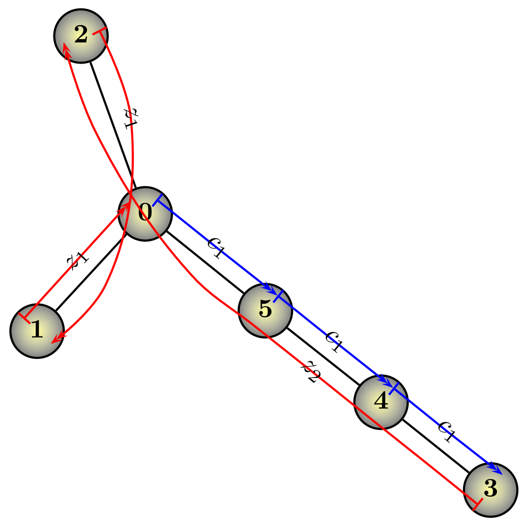



**GE Information**: Carrier: [0-2:z2+.] ; Carrier Dual: [2-4:z2+.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [0-2:z102+.]

and its dual are of opposite polarity, yet intersect. The base [0-1:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-22.1, as derived from the application of a print to root-22.

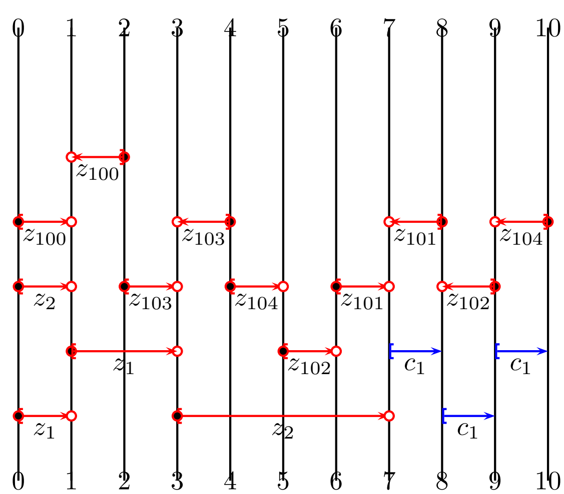
# 23 Cancellation scheme #23




| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 0 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 4 \leftarrow 5 \leftarrow 0 \leftarrow 2$ |
| $c_1$ | $4 \leftarrow 3$ |
| $c_1$ | $5 \leftarrow 4$ |
| $c_1$ | $0 \leftarrow 5$ |

## Generalized Equation root-23

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-3:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<2*<1=3*
```

We proceed.

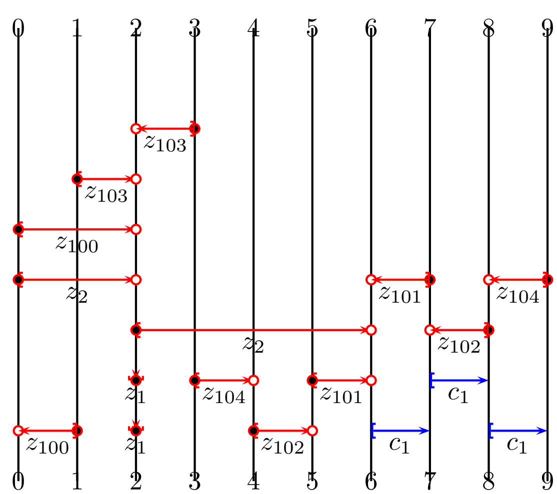
## Generalized Equation root-23.1

We begin from the GE root-23 (see pp. 119). We consider its print

```
Print 1: =0=1*<2*<1=3*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 3.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 3.
Step 3: Moved (old) base [0-1:z100+.] to (new) boundaries 1 - 3.
Step 4: Collapsed (new) base [1-3:z1+.] to the empty base (3,3).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-23.1—is illustrated below:

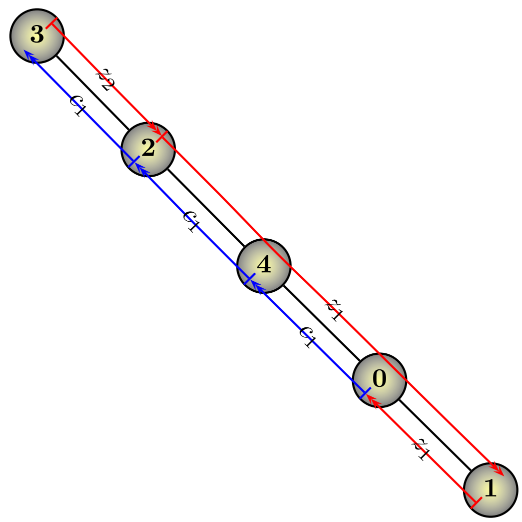



**GE Information**: Carrier: [0-2:z2+.] ; Carrier Dual: [2-6:z2+.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [0-2:z100+.]

and its dual are of opposite polarity, yet intersect. The base [0-1:z100-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-23.1, as derived from the application of a print to root-23.

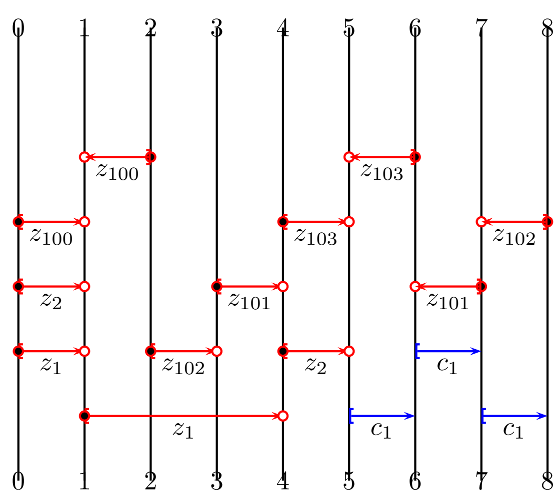
# 24 Cancellation scheme #24




| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 4 \leftarrow 0 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 2$ |
| $c_1$ | $2 \leftarrow 3$ |
| $c_1$ | $4 \leftarrow 2$ |
| $c_1$ | $0 \leftarrow 4$ |

## Generalized Equation root-24

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-4:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<2*<3*<1=4*
```

We proceed.

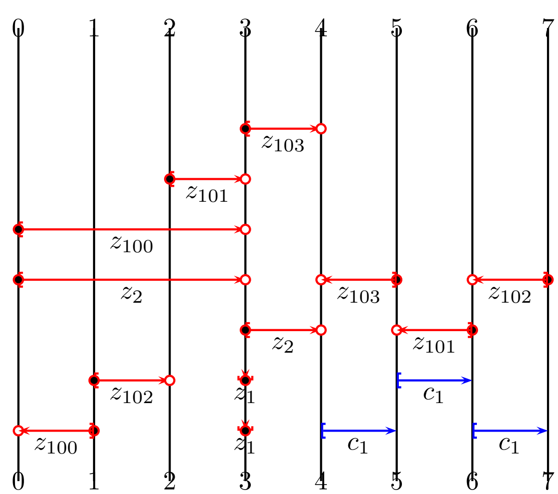
## Generalized Equation root-24.1

We begin from the GE root-24 (see pp. 122). We consider its print

```
Print 1: =0=1*<2*<3*<1=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 4.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 4.
Step 3: Moved (old) base [0-1:z100+.] to (new) boundaries 1 - 4.
Step 4: Collapsed (new) base [1-4:z1+.] to the empty base (4,4).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-24.1—is illustrated below:

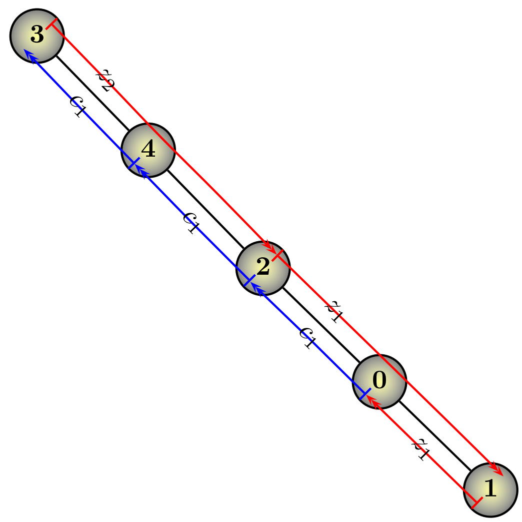



**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-4:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [0-3:z100+.]

and its dual are of opposite polarity, yet intersect. The base [0-1:z100-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-24.1, as derived from the application of a print to root-24.

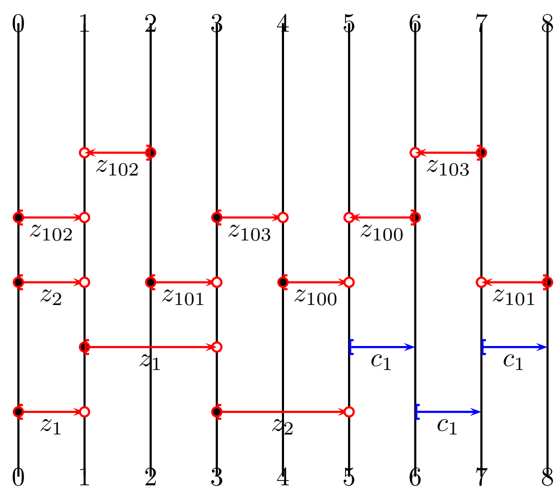
# 25 Cancellation scheme #25




| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 0 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 4 \leftarrow 2$ |
| $c_1$ | $4 \leftarrow 3$ |
| $c_1$ | $2 \leftarrow 4$ |
| $c_1$ | $0 \leftarrow 2$ |

## Generalized Equation root-25

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-3:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<2*<1=3*
```

We proceed.

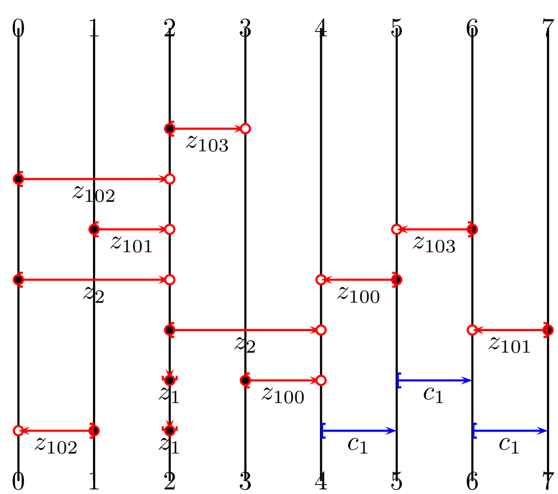
## Generalized Equation root-25.1

We begin from the GE root-25 (see pp. 125). We consider its print

```
Print 1: =0=1*<2*<1=3*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 3.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 3.
Step 3: Moved (old) base [0-1:z102+.] to (new) boundaries 1 - 3.
Step 4: Collapsed (new) base [1-3:z1+.] to the empty base (3,3).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-25.1—is illustrated below:

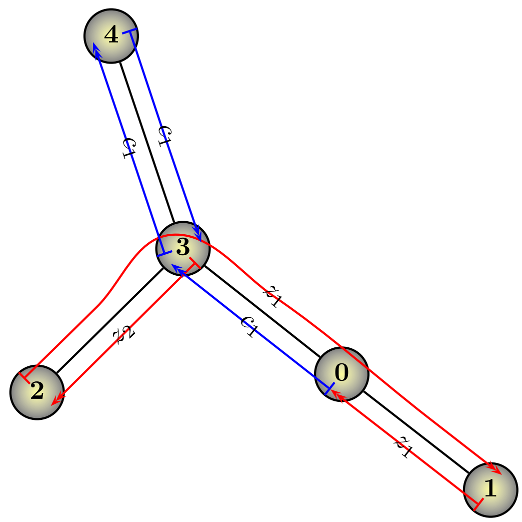



**GE Information**: Carrier: [0-2:z2+.] ; Carrier Dual: [2-4:z2+.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [0-2:z102+.]

and its dual are of opposite polarity, yet intersect. The base [0-1:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-25.1, as derived from the application of a print to root-25.

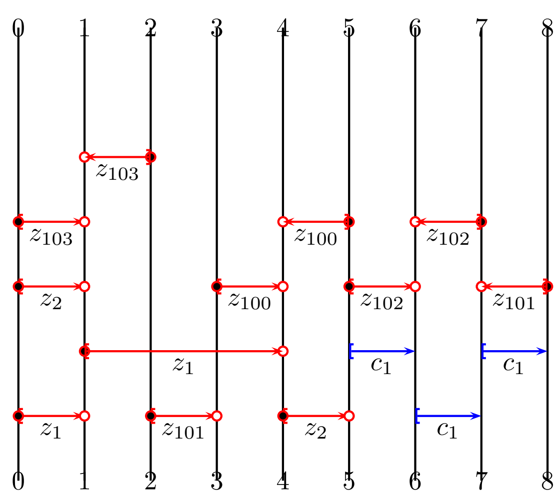
# 26 Cancellation scheme #26




| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 3 \leftarrow 0 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 2$ |
| $c_1$ | $4 \leftarrow 3$ |
| $c_1$ | $3 \leftarrow 4$ |
| $c_1$ | $0 \leftarrow 3$ |

## Generalized Equation root-26

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-4:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<2*<3*<1=4*
```

We proceed.

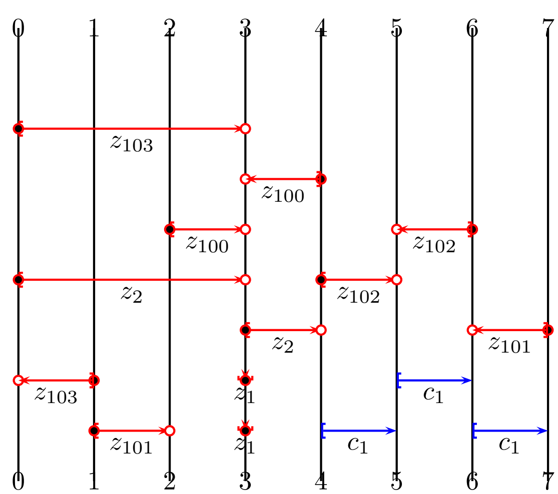
## Generalized Equation root-26.1

We begin from the GE root-26 (see pp. 128). We consider its print

```
Print 1: =0=1*<2*<3*<1=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 4.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 4.
Step 3: Moved (old) base [0-1:z103+.] to (new) boundaries 1 - 4.
Step 4: Collapsed (new) base [1-4:z1+.] to the empty base (4,4).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-26.1—is illustrated below:

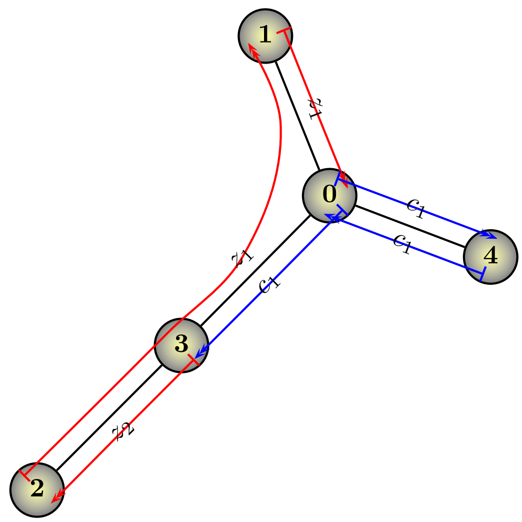



**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-4:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [0-3:z103+.]

and its dual are of opposite polarity, yet intersect. The base [0-1:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-26.1, as derived from the application of a print to root-26.

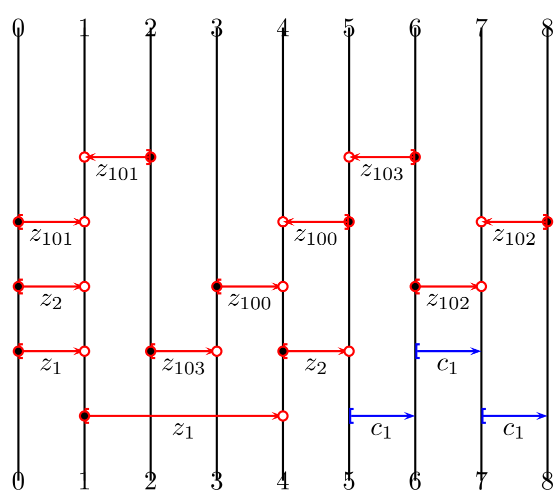
# 27 Cancellation scheme #27




| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 3 \leftarrow 0 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 2$ |
| $c_1$ | $0 \leftarrow 3$ |
| $c_1$ | $4 \leftarrow 0$ |
| $c_1$ | $0 \leftarrow 4$ |

## Generalized Equation root-27

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-4:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<2*<3*<1=4*
```

We proceed.

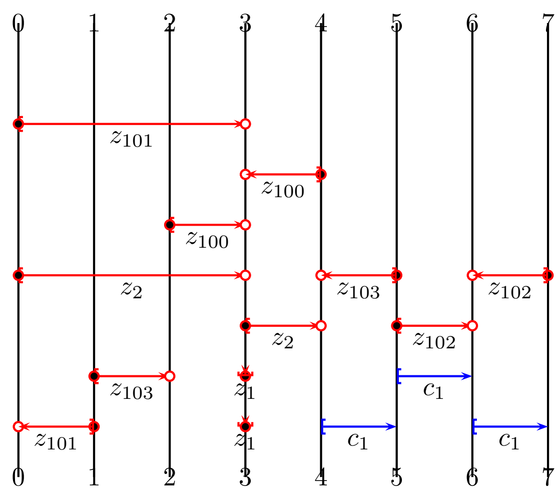
## Generalized Equation root-27.1

We begin from the GE root-27 (see pp. 131). We consider its print

```
Print 1: =0=1*<2*<3*<1=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 4.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 4.
Step 3: Moved (old) base [0-1:z101+.] to (new) boundaries 1 - 4.
Step 4: Collapsed (new) base [1-4:z1+.] to the empty base (4,4).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-27.1—is illustrated below:

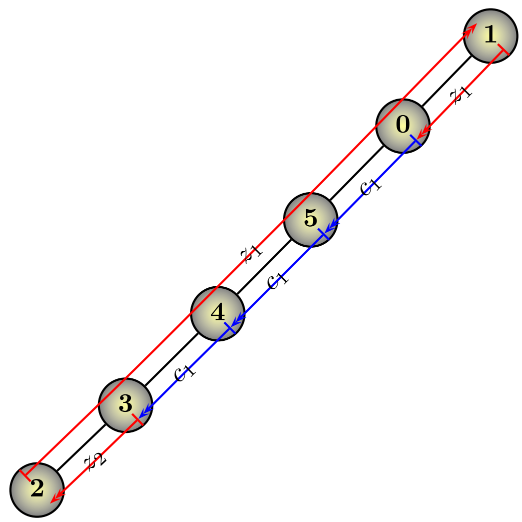



**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-4:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [0-3:z101+.]

and its dual are of opposite polarity, yet intersect. The base [0-1:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-27.1, as derived from the application of a print to root-27.

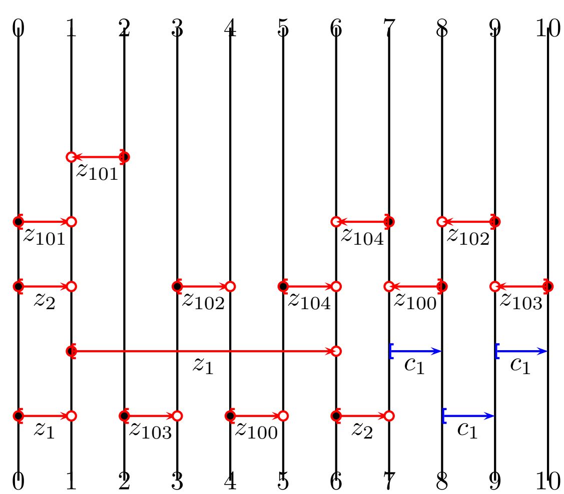
# 28 Cancellation scheme #28



| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 3 \leftarrow 4 \leftarrow 5 \leftarrow 0 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 2$ |
| $c_1$ | $4 \leftarrow 3$ |
| $c_1$ | $5 \leftarrow 4$ |
| $c_1$ | $0 \leftarrow 5$ |

## Generalized Equation root-28

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-6:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<2*<3*<4*<5*<1=6*
```

We proceed.

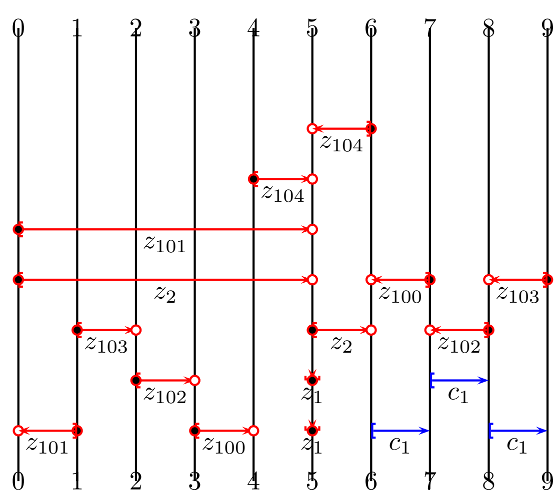
## Generalized Equation root-28.1

We begin from the GE root-28 (see pp. 134). We consider its print

```
Print 1: =0=1*<2*<3*<4*<5*<1=6*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 6.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 6.
Step 3: Moved (old) base [0-1:z101+.] to (new) boundaries 1 - 6.
Step 4: Collapsed (new) base [1-6:z1+.] to the empty base (6,6).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-28.1—is illustrated below:

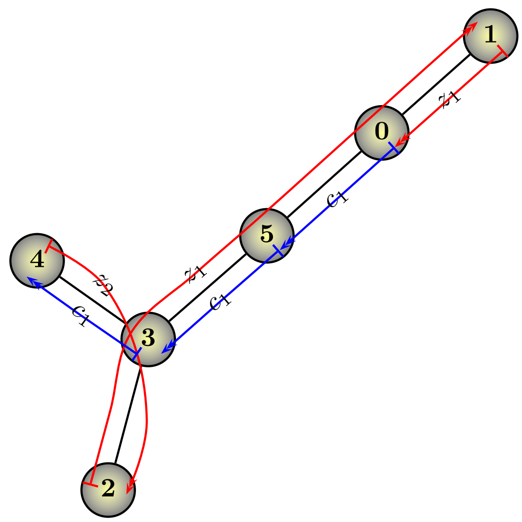



**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-6:z2+.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [0-5:z101+.]

and its dual are of opposite polarity, yet intersect. The base [0-1:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-28.1, as derived from the application of a print to root-28.

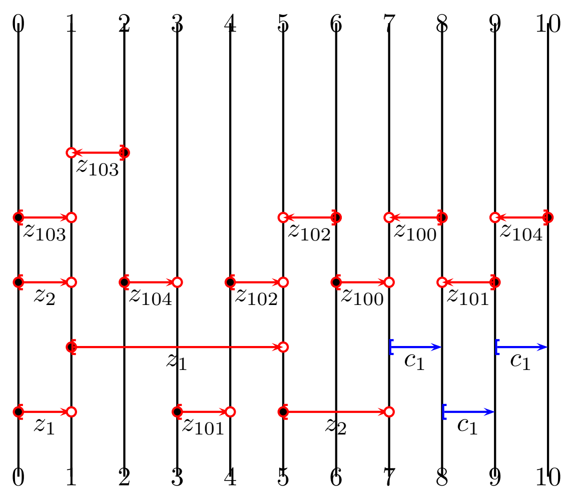
# 29 Cancellation scheme #29




| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 3 \leftarrow 5 \leftarrow 0 \leftarrow 1$ |
| $z_2$ | $4 \leftarrow 3 \leftarrow 2$ |
| $c_1$ | $3 \leftarrow 4$ |
| $c_1$ | $5 \leftarrow 3$ |
| $c_1$ | $0 \leftarrow 5$ |

## Generalized Equation root-29

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-5:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<2*<3*<4*<1=5*
```

We proceed.

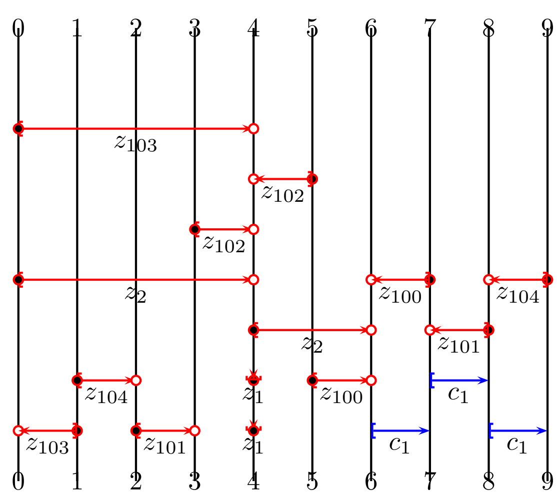
## Generalized Equation root-29.1

We begin from the GE root-29 (see pp. 137). We consider its print

```
Print 1: =0=1*<2*<3*<4*<1=5*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 5.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 5.
Step 3: Moved (old) base [0-1:z103+.] to (new) boundaries 1 - 5.
Step 4: Collapsed (new) base [1-5:z1+.] to the empty base (5,5).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-29.1—is illustrated below:

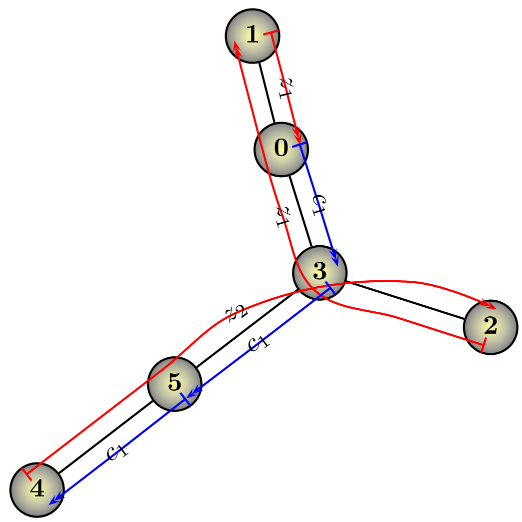



**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-6:z2+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [0-4:z103+.]

and its dual are of opposite polarity, yet intersect. The base [0-1:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-29.1, as derived from the application of a print to root-29.

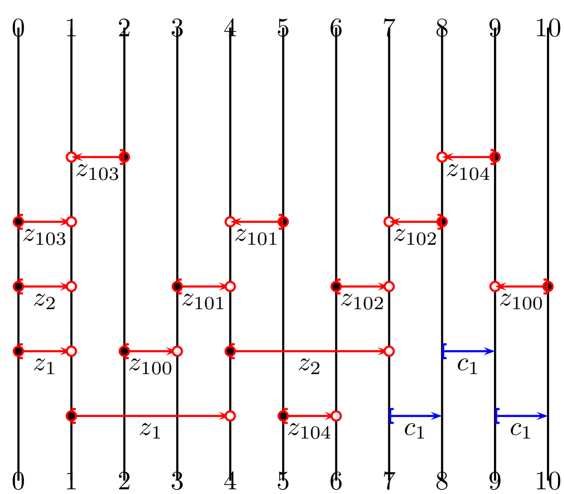
# 30 Cancellation scheme #30



| | |
|---|---|
| $z_1$ | $1 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 3 \leftarrow 0 \leftarrow 1$ |
| $z_2$ | $4 \leftarrow 5 \leftarrow 3 \leftarrow 2$ |
| $c_1$ | $5 \leftarrow 4$ |
| $c_1$ | $3 \leftarrow 5$ |
| $c_1$ | $0 \leftarrow 3$ |

## Generalized Equation root-30

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-1:z1+.] ; Carrier Dual: [1-4:z1+.] ; Critical Boundary: 1; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=1*<2*<3*<1=4*
```

We proceed.

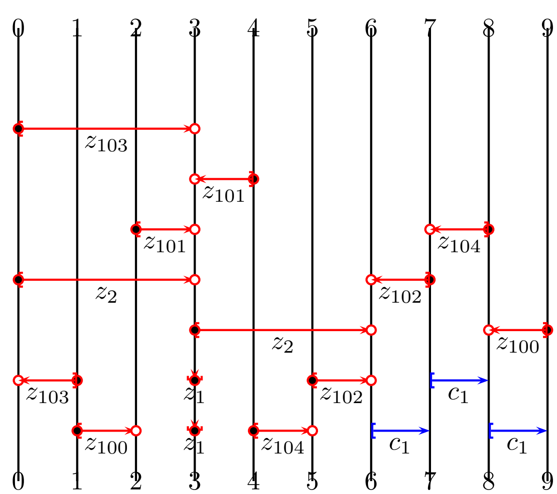
## Generalized Equation root-30.1

We begin from the GE root-30 (see pp. 140). We consider its print

```
Print 1: =0=1*<2*<3*<1=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Moved (old) base [0-1:z1+.] to (new) boundaries 1 - 4.
Step 2: Moved (old) base [0-1:z2+.] to (new) boundaries 1 - 4.
Step 3: Moved (old) base [0-1:z103+.] to (new) boundaries 1 - 4.
Step 4: Collapsed (new) base [1-4:z1+.] to the empty base (4,4).
Step 5: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-30.1—is illustrated below:

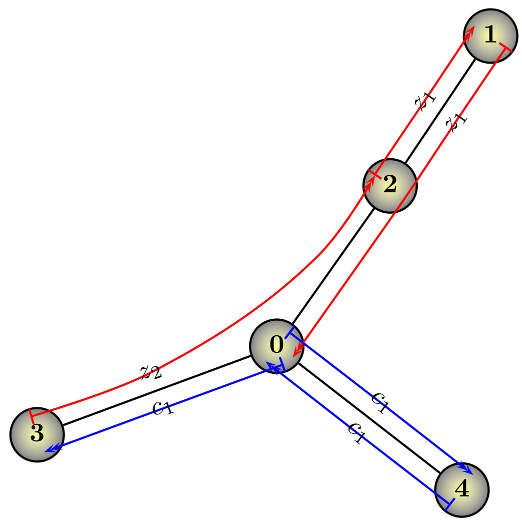



**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-6:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [0-3:z103+.]

and its dual are of opposite polarity, yet intersect. The base [0-1:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-30.1, as derived from the application of a print to root-30.

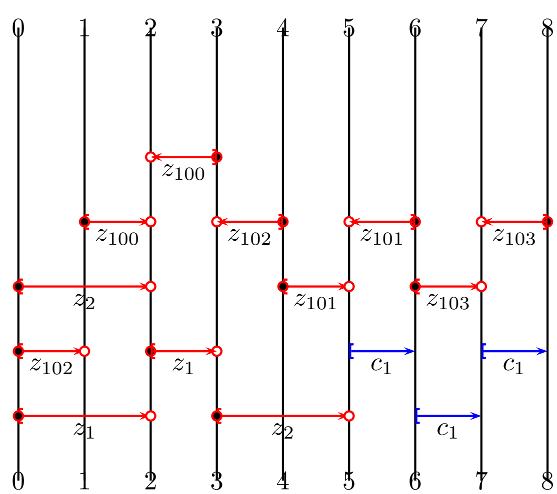
# 31 Cancellation scheme #31




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 0 \leftarrow 2$ |
| $c_1$ | $0 \leftarrow 3$ |
| $c_1$ | $4 \leftarrow 0$ |
| $c_1$ | $0 \leftarrow 4$ |

## Generalized Equation root-31

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-2:z1+.] ; Carrier Dual: [2-3:z1+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1<2=3*
```

We proceed.

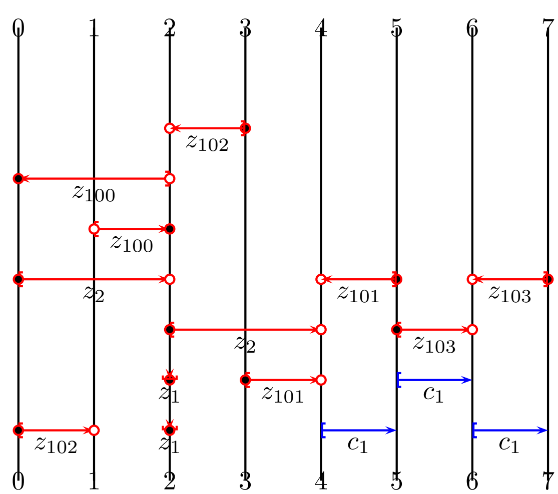
## Generalized Equation root-31.1

We begin from the GE root-31 (see pp. 143). We consider its print

```
Print 1: =0=2*<1<2=3*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 4.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 4.
Step 4: Moved (old) base [1-2:z100+.] to (new) boundaries 3 - 4.
Step 5: Moved (old) base [0-1:z102+.] to (new) boundaries 2 - 3.
Step 6: Collapsed (new) base [2-4:z1+.] to the empty base (4,4).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-31.1—is illustrated below:



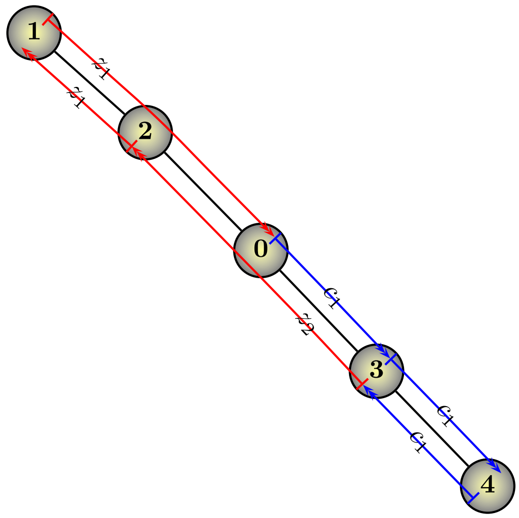
$$z_1 z_1 z_1 c_1 c_1 c_1 =_F 1$$

---

**GE Information**: Carrier: [0-2:z2+.] ; Carrier Dual: [2-4:z2+.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [1-2:z100+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z100-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-31.1, as derived from the application of a print to root-31.

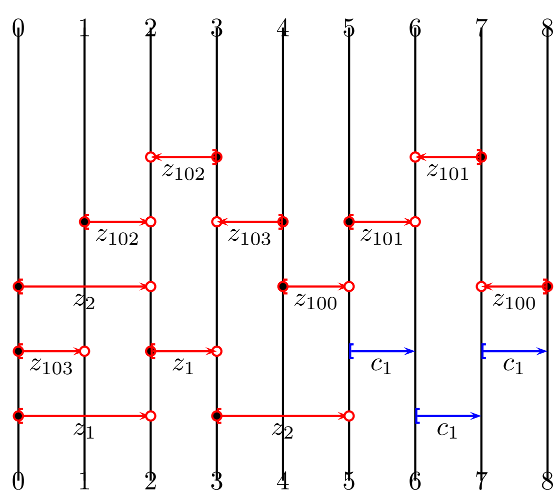
# 32 Cancellation scheme #32




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 0 \leftarrow 2$ |
| $c_1$ | $4 \leftarrow 3$ |
| $c_1$ | $3 \leftarrow 4$ |
| $c_1$ | $0 \leftarrow 3$ |

## Generalized Equation root-32

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-2:z1+.] ; Carrier Dual: [2-3:z1+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1<2=3*
```

We proceed.

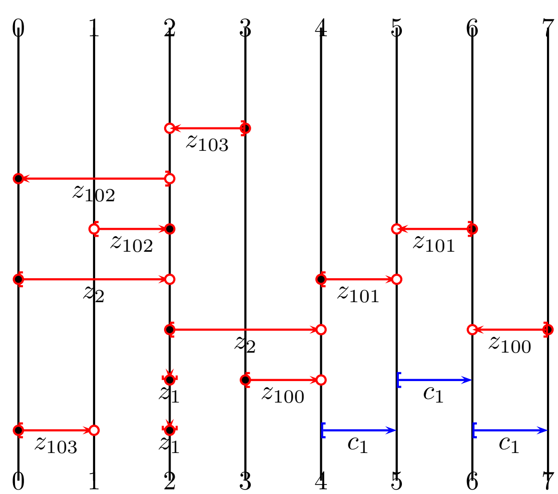
## Generalized Equation root-32.1

We begin from the GE root-32 (see pp. 146). We consider its print

```
Print 1: =0=2*<1<2=3*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 4.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 4.
Step 4: Moved (old) base [1-2:z102+.] to (new) boundaries 3 - 4.
Step 5: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 3.
Step 6: Collapsed (new) base [2-4:z1+.] to the empty base (4,4).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

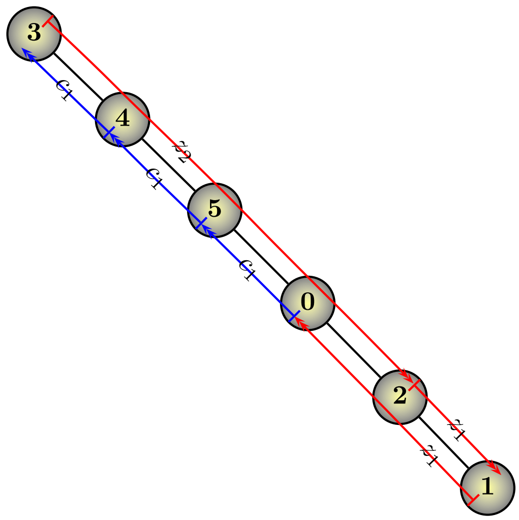
Upon applying the print, the GE we obtain—which we refer to as root-32.1—is illustrated below:



**GE Information**: Carrier: [0-2:z2+.] ; Carrier Dual: [2-4:z2+.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [1-2:z102+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-32.1, as derived from the application of a print to root-32.

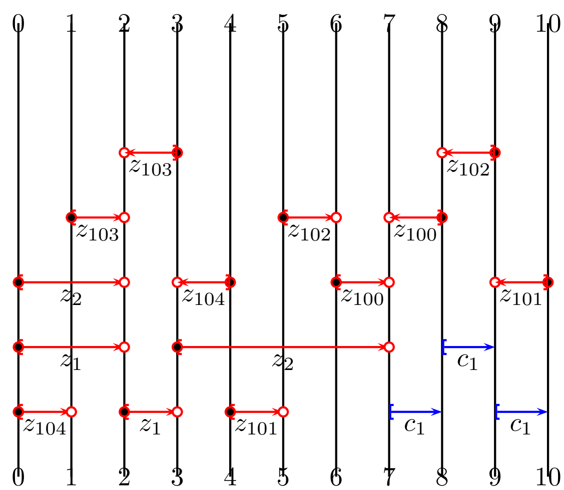
# 33 Cancellation scheme #33




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 4 \leftarrow 5 \leftarrow 0 \leftarrow 2$ |
| $c_1$ | $4 \leftarrow 3$ |
| $c_1$ | $5 \leftarrow 4$ |
| $c_1$ | $0 \leftarrow 5$ |

## Generalized Equation root-33

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-2:z1+.] ; Carrier Dual: [2-3:z1+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1<2=3*
```

We proceed.

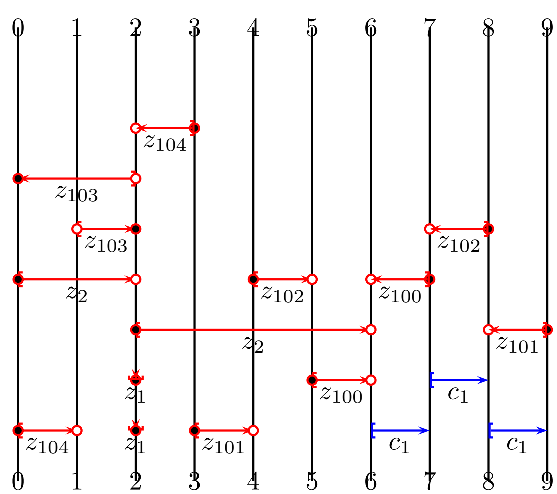
## Generalized Equation root-33.1

We begin from the GE root-33 (see pp. 149). We consider its print

```
Print 1: =0=2*<1<2=3*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 4.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 4.
Step 4: Moved (old) base [1-2:z103+.] to (new) boundaries 3 - 4.
Step 5: Moved (old) base [0-1:z104+.] to (new) boundaries 2 - 3.
Step 6: Collapsed (new) base [2-4:z1+.] to the empty base (4,4).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-33.1—is illustrated below:

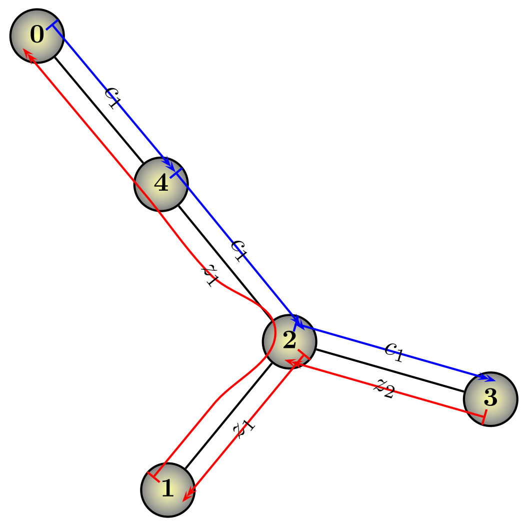


$$z_1 z_1 z_1 c_1 c_1 c_1 =_F 1$$

**GE Information**: Carrier: [0-2:z2+.] ; Carrier Dual: [2-6:z2+.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [1-2:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-33.1, as derived from the application of a print to root-33.

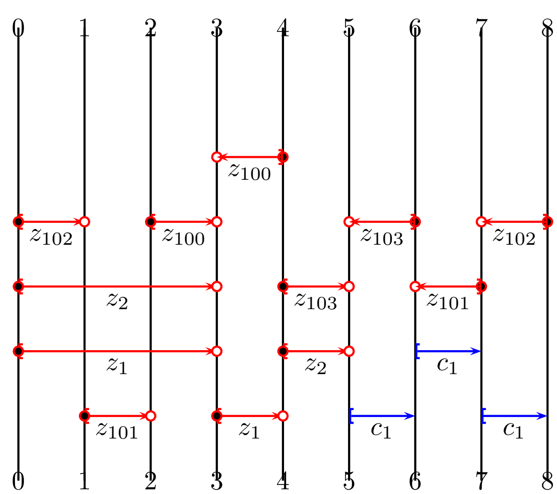
# 34 Cancellation scheme #34




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 4 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 2$ |
| $c_1$ | $2 \leftarrow 3$ |
| $c_1$ | $4 \leftarrow 2$ |
| $c_1$ | $0 \leftarrow 4$ |

## Generalized Equation root-34

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-3:z1+.] ; Carrier Dual: [3-4:z1+.] ; Critical Boundary: 3; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=3*<1<2<3=4*
```

We proceed.

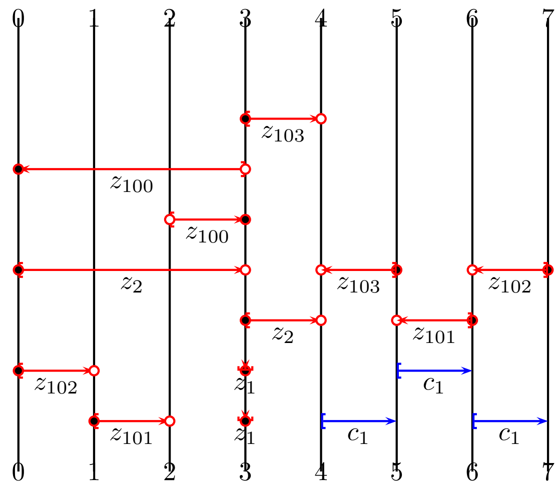
## Generalized Equation root-34.1

We begin from the GE root-34 (see pp. 152). We consider its print

```
Print 1: =0=3*<1<2<3=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 5.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 6.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 6.
Step 5: Moved (old) base [2-3:z100+.] to (new) boundaries 5 - 6.
Step 6: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 5.
Step 7: Moved (old) base [0-1:z102+.] to (new) boundaries 3 - 4.
Step 8: Collapsed (new) base [3-6:z1+.] to the empty base (6,6).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

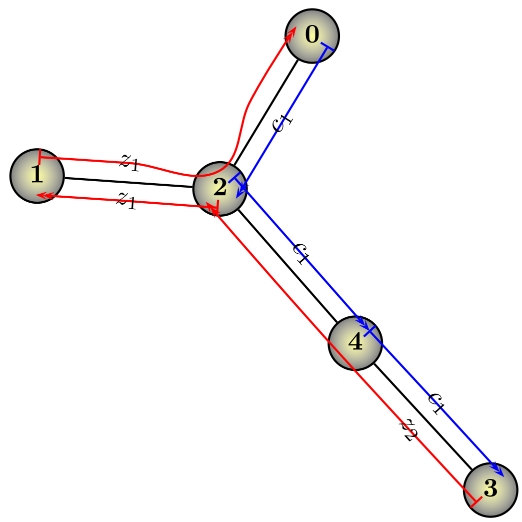
Upon applying the print, the GE we obtain—which we refer to as root-34.1—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-4:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [2-3:z100+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z100-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-34.1, as derived from the application of a print to root-34.

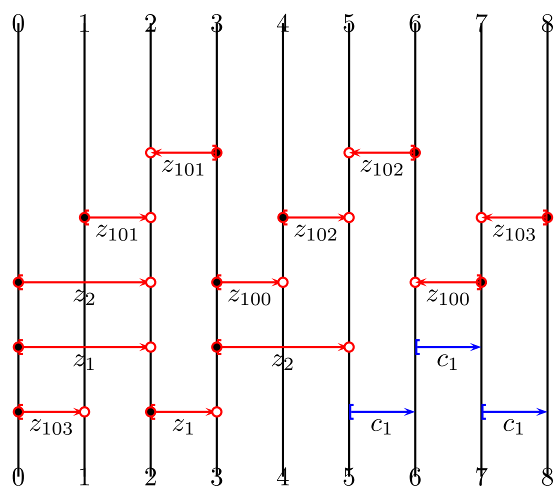
# 35 Cancellation scheme #35




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 4 \leftarrow 2$ |
| $c_1$ | $4 \leftarrow 3$ |
| $c_1$ | $2 \leftarrow 4$ |
| $c_1$ | $0 \leftarrow 2$ |

## Generalized Equation root-35

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-2:z1+.] ; Carrier Dual: [2-3:z1+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1<2=3*
```

We proceed.

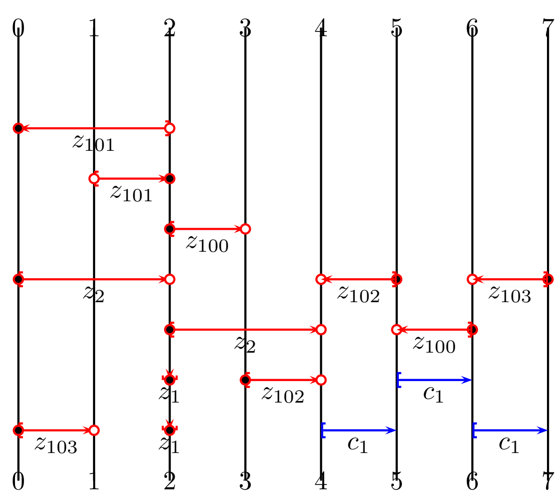
## Generalized Equation root-35.1

We begin from the GE root-35 (see pp. 155). We consider its print

```
Print 1: =0=2*<1<2=3*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 4.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 4.
Step 4: Moved (old) base [1-2:z101+.] to (new) boundaries 3 - 4.
Step 5: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 3.
Step 6: Collapsed (new) base [2-4:z1+.] to the empty base (4,4).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-35.1—is illustrated below:

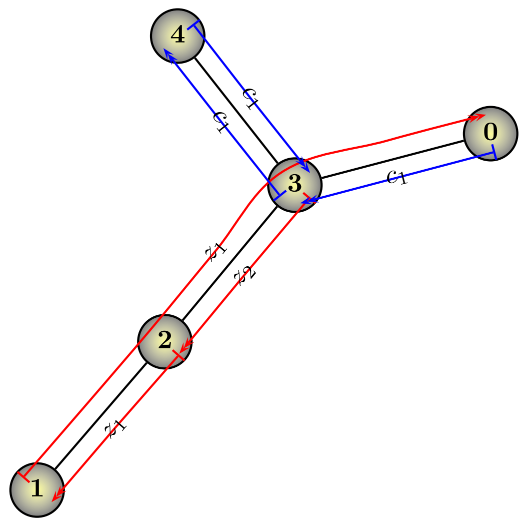


$$z_1 z_1 z_1 c_1 c_1 c_1 =_F 1$$

**GE Information**: Carrier: [0-2:z2+.] ; Carrier Dual: [2-4:z2+.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [1-2:z101+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-35.1, as derived from the application of a print to root-35.

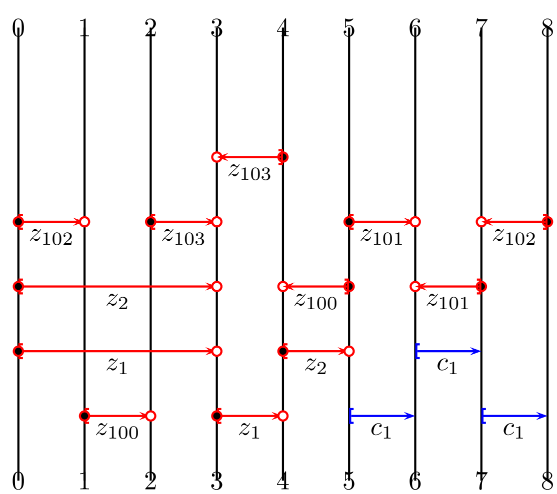
# 36 Cancellation scheme #36




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 3 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 2$ |
| $c_1$ | $4 \leftarrow 3$ |
| $c_1$ | $3 \leftarrow 4$ |
| $c_1$ | $0 \leftarrow 3$ |

## Generalized Equation root-36

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-3:z1+.] ; Carrier Dual: [3-4:z1+.] ; Critical Boundary: 3; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=3*<1<2<3=4*
```

We proceed.

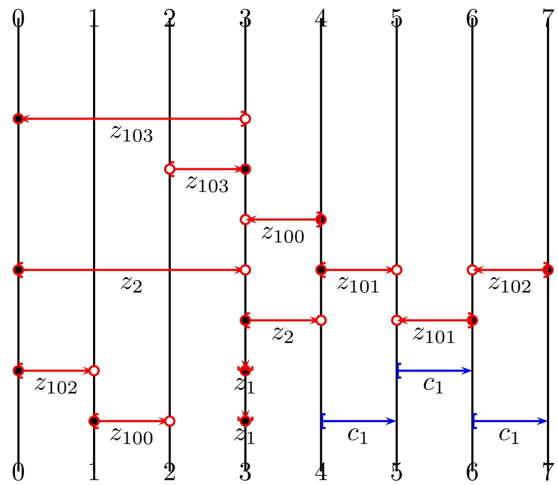
## Generalized Equation root-36.1

We begin from the GE root-36 (see pp. 158). We consider its print

```
Print 1: =0=3*<1<2<3=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 5.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 6.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 6.
Step 5: Moved (old) base [1-2:z100+.] to (new) boundaries 4 - 5.
Step 6: Moved (old) base [0-1:z102+.] to (new) boundaries 3 - 4.
Step 7: Moved (old) base [2-3:z103+.] to (new) boundaries 5 - 6.
Step 8: Collapsed (new) base [3-6:z1+.] to the empty base (6,6).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

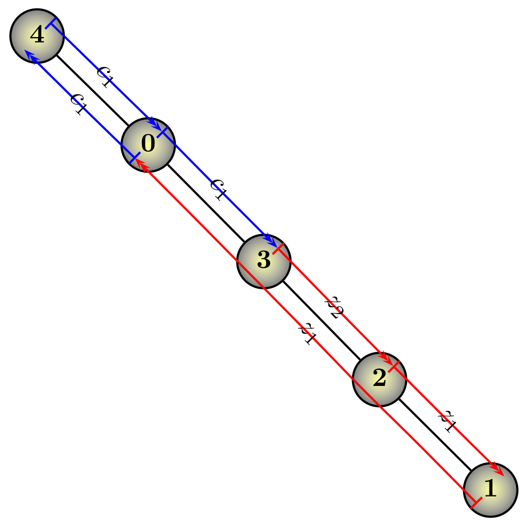
Upon applying the print, the GE we obtain—which we refer to as root-36.1—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-4:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [2-3:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-36.1, as derived from the application of a print to root-36.

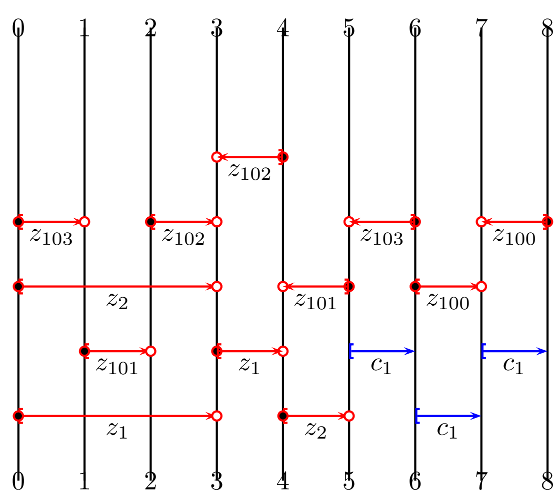
# 37 Cancellation scheme #37




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 3 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 2$ |
| $c_1$ | $0 \leftarrow 3$ |
| $c_1$ | $4 \leftarrow 0$ |
| $c_1$ | $0 \leftarrow 4$ |

## Generalized Equation root-37

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-3:z1+.] ; Carrier Dual: [3-4:z1+.] ; Critical Boundary: 3; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=3*<1<2<3=4*
```

We proceed.

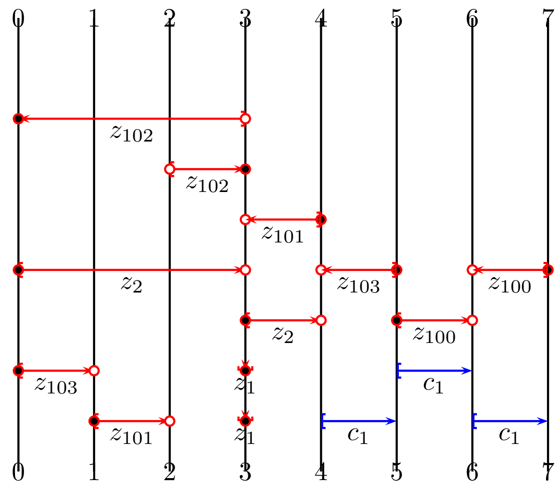
## Generalized Equation root-37.1

We begin from the GE root-37 (see pp. 161). We consider its print

```
Print 1: =0=3*<1<2<3=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 5.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 6.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 6.
Step 5: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 5.
Step 6: Moved (old) base [2-3:z102+.] to (new) boundaries 5 - 6.
Step 7: Moved (old) base [0-1:z103+.] to (new) boundaries 3 - 4.
Step 8: Collapsed (new) base [3-6:z1+.] to the empty base (6,6).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

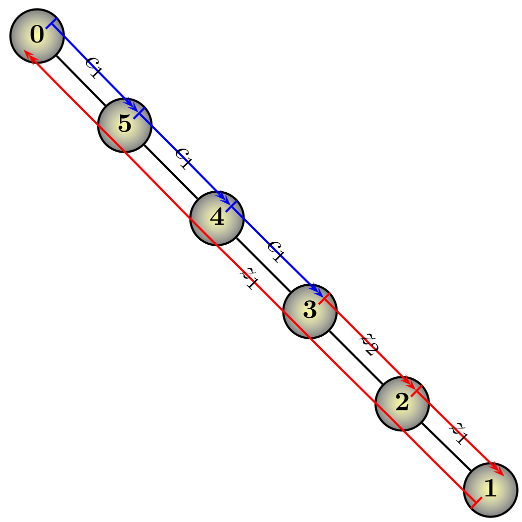
Upon applying the print, the GE we obtain—which we refer to as root-37.1—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-4:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [2-3:z102+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-37.1, as derived from the application of a print to root-37.

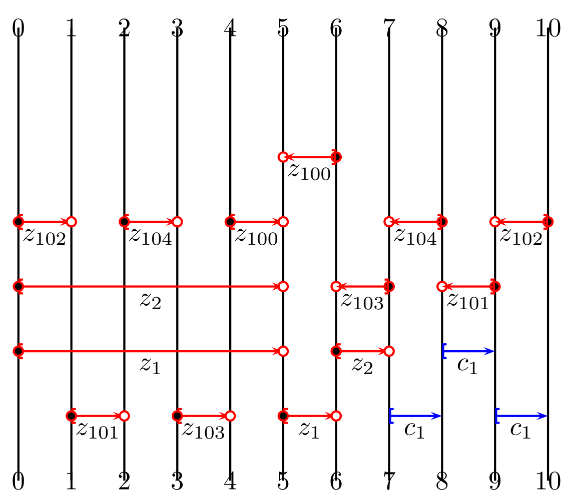
# 38 Cancellation scheme #38



| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 3 \leftarrow 4 \leftarrow 5 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $3 \leftarrow 2$ |
| $c_1$ | $4 \leftarrow 3$ |
| $c_1$ | $5 \leftarrow 4$ |
| $c_1$ | $0 \leftarrow 5$ |

## Generalized Equation root-38

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-5:z1+.] ; Carrier Dual: [5-6:z1+.] ; Critical Boundary: 5; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=5*<1<2<3<4<5=6*
```

We proceed.

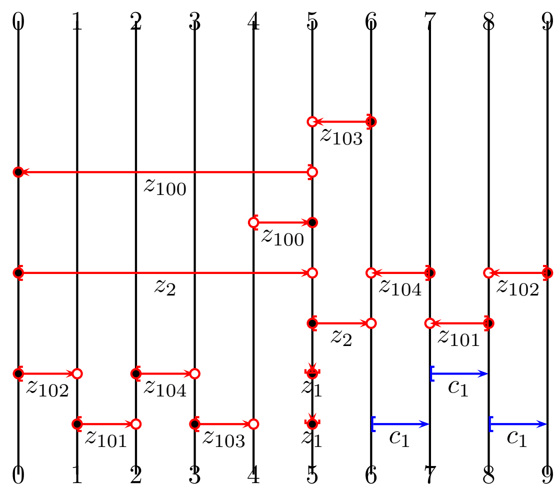
## Generalized Equation root-38.1

We begin from the GE root-38 (see pp. 164). We consider its print

```
Print 1: =0=5*<1<2<3<4<5=6*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 7.
Step 3: Added (new) boundary 8.
Step 4: Added (new) boundary 9.
Step 5: Moved (old) base [0-5:z1+.] to (new) boundaries 5 - 10.
Step 6: Moved (old) base [0-5:z2+.] to (new) boundaries 5 - 10.
Step 7: Moved (old) base [4-5:z100+.] to (new) boundaries 9 - 10.
Step 8: Moved (old) base [1-2:z101+.] to (new) boundaries 6 - 7.
Step 9: Moved (old) base [0-1:z102+.] to (new) boundaries 5 - 6.
Step 10: Moved (old) base [3-4:z103+.] to (new) boundaries 8 - 9.
Step 11: Moved (old) base [2-3:z104+.] to (new) boundaries 7 - 8.
Step 12: Collapsed (new) base [5-10:z1+.] to the empty base (10,10).
Step 13: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 15: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 16: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 17: Deleted (new) boundary 4 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

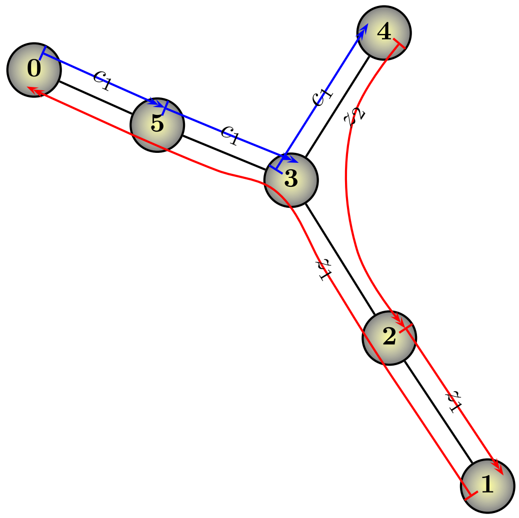
Upon applying the print, the GE we obtain—which we refer to as root-38.1—is illustrated below:




**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-6:z2+.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [4-5:z100+.] and its dual are of opposite polarity, yet intersect. The base [0-5:z100-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-38.1, as derived from the application of a print to root-38.

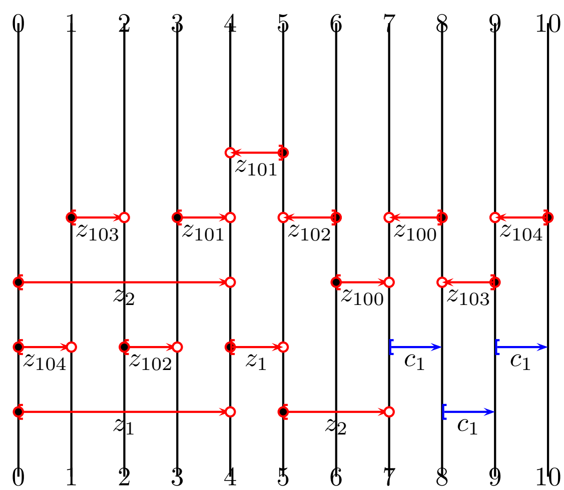
# 39 Cancellation scheme #39




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 3 \leftarrow 5 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $4 \leftarrow 3 \leftarrow 2$ |
| $c_1$ | $3 \leftarrow 4$ |
| $c_1$ | $5 \leftarrow 3$ |
| $c_1$ | $0 \leftarrow 5$ |

## Generalized Equation root-39

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-4:z1+.] ; Carrier Dual: [4-5:z1+.] ; Critical Boundary: 4; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=4*<1<2<3<4=5*
```

We proceed.

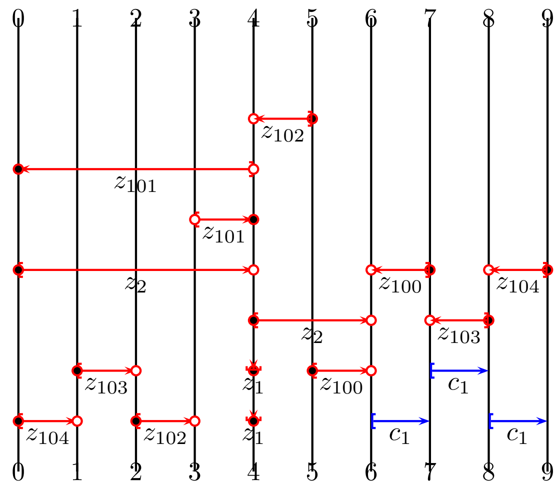
## Generalized Equation root-39.1

We begin from the GE root-39 (see pp. 167). We consider its print

```
Print 1: =0=4*<1<2<3<4=5*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Added (new) boundary 7.
Step 4: Moved (old) base [0-4:z1+.] to (new) boundaries 4 - 8.
Step 5: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 8.
Step 6: Moved (old) base [3-4:z101+.] to (new) boundaries 7 - 8.
Step 7: Moved (old) base [2-3:z102+.] to (new) boundaries 6 - 7.
Step 8: Moved (old) base [1-2:z103+.] to (new) boundaries 5 - 6.
Step 9: Moved (old) base [0-1:z104+.] to (new) boundaries 4 - 5.
Step 10: Collapsed (new) base [4-8:z1+.] to the empty base (8,8).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

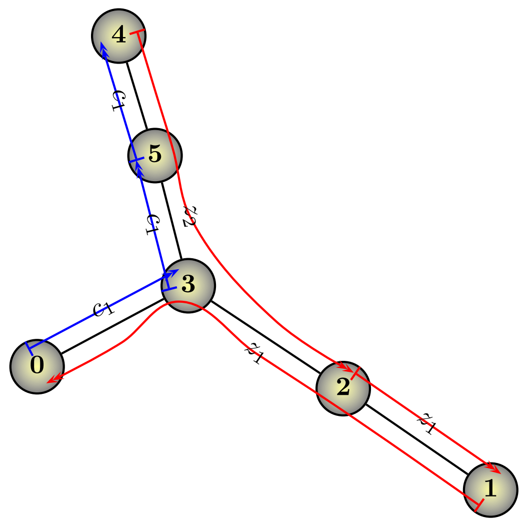
Upon applying the print, the GE we obtain—which we refer to as root-39.1—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-6:z2+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [3-4:z101+.] and its dual are of opposite polarity, yet intersect. The base [0-4:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-39.1, as derived from the application of a print to root-39.

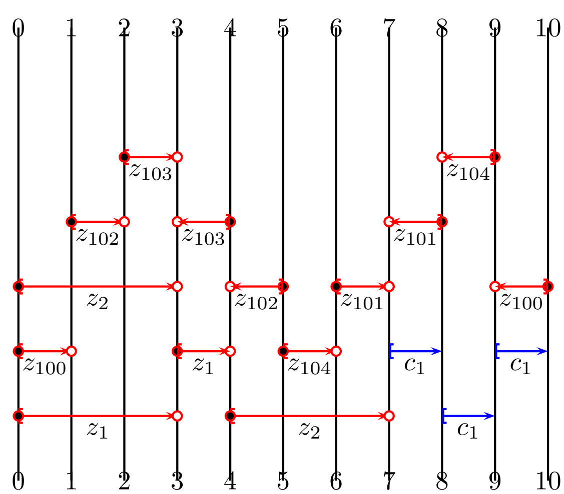
# 40 Cancellation scheme #40




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 3 \leftarrow 0$ |
| $z_1$ | $2 \leftarrow 1$ |
| $z_2$ | $4 \leftarrow 5 \leftarrow 3 \leftarrow 2$ |
| $c_1$ | $5 \leftarrow 4$ |
| $c_1$ | $3 \leftarrow 5$ |
| $c_1$ | $0 \leftarrow 3$ |

## Generalized Equation root-40

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-3:z1+.] ; Carrier Dual: [3-4:z1+.] ; Critical Boundary: 3; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=3*<1<2<3=4*
```

We proceed.

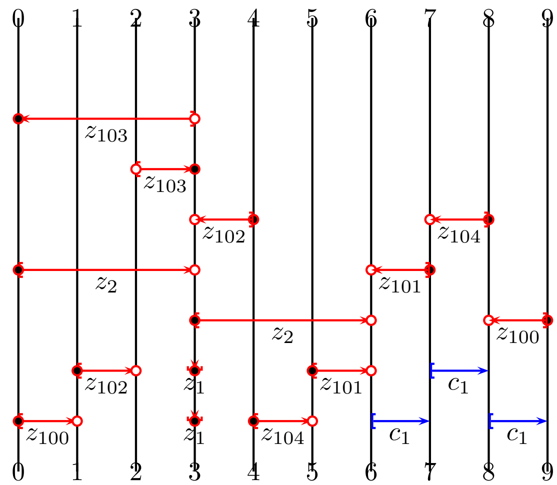
## Generalized Equation root-40.1

We begin from the GE root-40 (see pp. 170). We consider its print

```
Print 1: =0=3*<1<2<3=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 5.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 6.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 6.
Step 5: Moved (old) base [0-1:z100+.] to (new) boundaries 3 - 4.
Step 6: Moved (old) base [1-2:z102+.] to (new) boundaries 4 - 5.
Step 7: Moved (old) base [2-3:z103+.] to (new) boundaries 5 - 6.
Step 8: Collapsed (new) base [3-6:z1+.] to the empty base (6,6).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

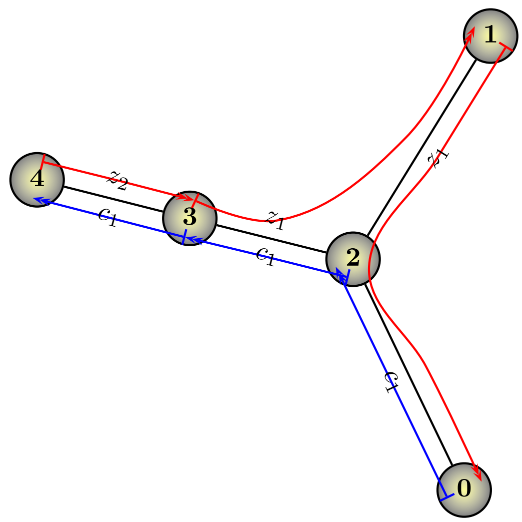
Upon applying the print, the GE we obtain—which we refer to as root-40.1—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-6:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [2-3:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-40.1, as derived from the application of a print to root-40.

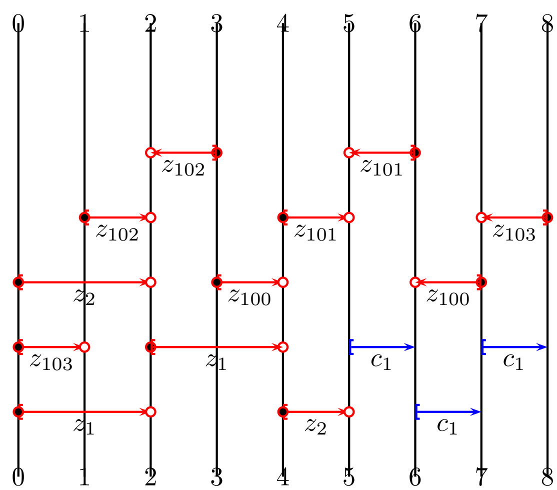
# 41 Cancellation scheme #41




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 0$ |
| $z_1$ | $3 \leftarrow 2 \leftarrow 1$ |
| $z_2$ | $4 \leftarrow 3$ |
| $c_1$ | $3 \leftarrow 4$ |
| $c_1$ | $2 \leftarrow 3$ |
| $c_1$ | $0 \leftarrow 2$ |

## Generalized Equation root-41

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-2:z1+.] ; Carrier Dual: [2-4:z1+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 2 valid prints (descendents).

It has 2 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1<3*<2=4*
Print 2: =0=2*<3*<1<2=4*
```

We proceed.

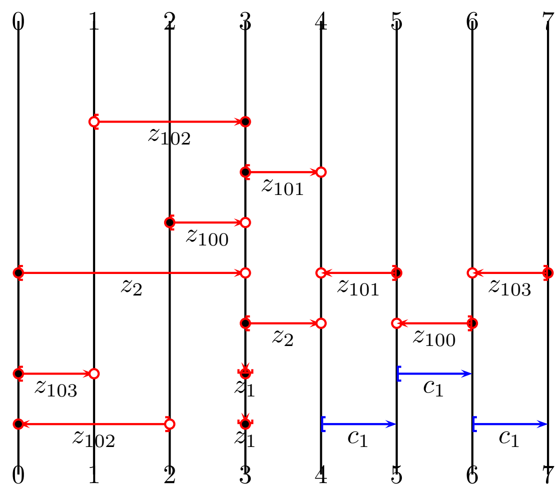
## Generalized Equation root-41.1

We begin from the GE root-41 (see pp. 173). We consider its print

```
Print 1: =0=2*<1<3*<2=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 4: Moved (old) base [1-2:z102+.] to (new) boundaries 3 - 5.
Step 5: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 3.
Step 6: Collapsed (new) base [2-5:z1+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-41.1—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-4:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [1-3:z102+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-41.1, as derived from the application of a print to root-41.

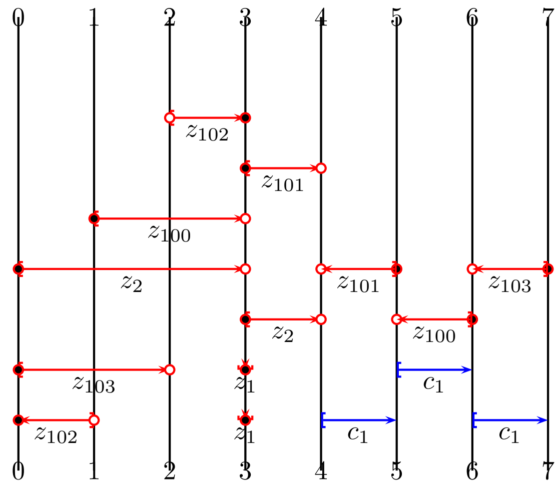
## Generalized Equation root-41.2

We begin from the GE root-41 (see pp. 173). We consider its print

```
Print 2: =0=2*<3*<1<2=4*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 4: Moved (old) base [1-2:z102+.] to (new) boundaries 4 - 5.
Step 5: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 4.
Step 6: Collapsed (new) base [2-5:z1+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

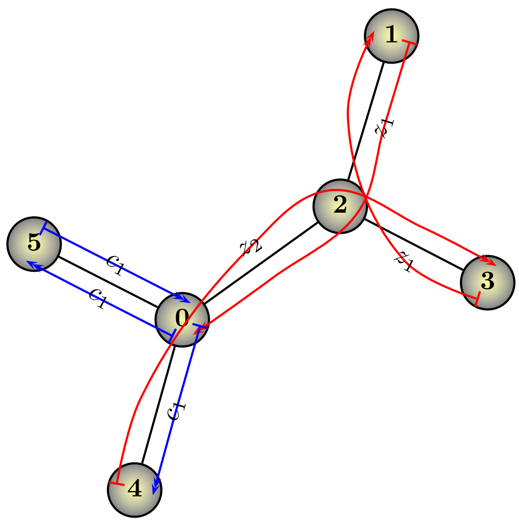
Upon applying the print, the GE we obtain—which we refer to as root-41.2—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-4:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [5-6:z100-.] has constraints with its dual that stretch the constant segment 5 - 6 to length different from 1. The base [6-7:z103-.] has constraints with its dual that stretch the constant segment 6 - 7 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-41.2, as derived from the application of a print to root-41.

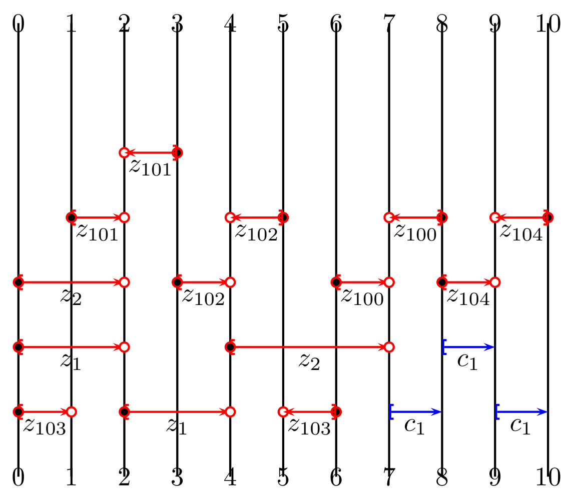
# 42 Cancellation scheme #42




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 0$ |
| $z_1$ | $3 \leftarrow 2 \leftarrow 1$ |
| $z_2$ | $4 \leftarrow 0 \leftarrow 2 \leftarrow 3$ |
| $c_1$ | $0 \leftarrow 4$ |
| $c_1$ | $5 \leftarrow 0$ |
| $c_1$ | $0 \leftarrow 5$ |

## Generalized Equation root-42

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-2:z1+.] ; Carrier Dual: [2-4:z1+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 2 valid prints (descendents).

It has 2 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1<3*<2=4*
Print 2: =0=2*<3*<1<2=4*
```

We proceed.

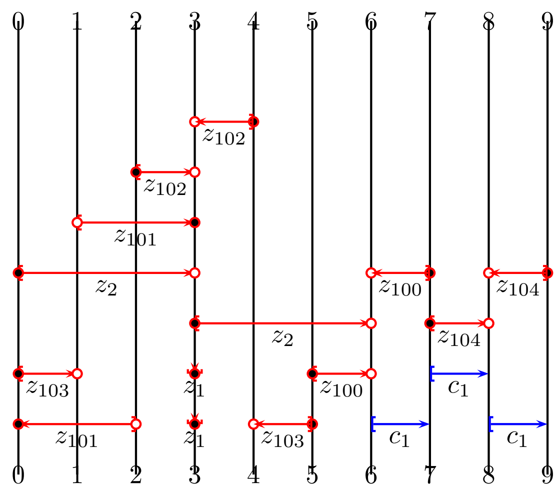
## Generalized Equation root-42.1

We begin from the GE root-42 (see pp. 177). We consider its print

```
Print 1: =0=2*<1<3*<2=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 4: Moved (old) base [1-2:z101+.] to (new) boundaries 3 - 5.
Step 5: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 3.
Step 6: Collapsed (new) base [2-5:z1+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-42.1—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-6:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [1-3:z101+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-42.1, as derived from the application of a print to root-42.

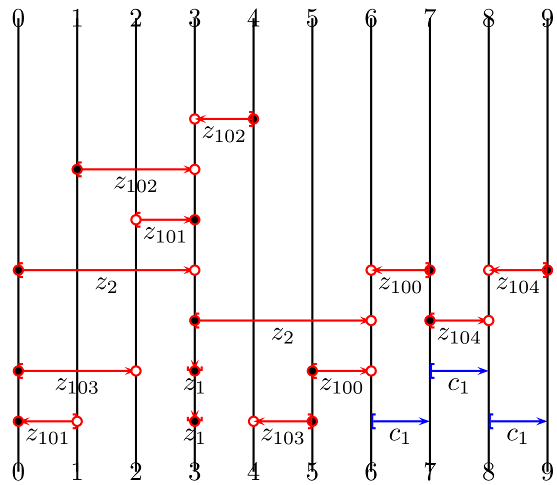
## Generalized Equation root-42.2

We begin from the GE root-42 (see pp. 177). We consider its print

```
Print 2: =0=2*<3*<1<2=4*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 4: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 5.
Step 5: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 4.
Step 6: Collapsed (new) base [2-5:z1+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-42.2—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-6:z2+.] ; Critical Boundary: 3; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 9 valid prints (descendents).

It has 9 legal carrier-to-dual prints, as follows:

```
Print 1: =0=3*<1<2<4*<5*<3=6*
Print 2: =0=3*<1<4*<2=5*<3=6*
Print 3: =0=3*<1<4*<2<5*<3=6*
Print 4: =0=3*<1<4*<5*<2<3=6*
Print 5: =0=3*<4*<1<2=5*<3=6*
Print 6: =0=3*<4*<1<2<5*<3=6*
Print 7: =0=3*<4*<1=5*<2<3=6*
Print 8: =0=3*<4*<1<5*<2<3=6*
Print 9: =0=3*<4*<5*<1<2<3=6*
```

This completes the consideration of root-42.2, as derived from the application of a print to root-42.

## Generalized Equation root-42.2.1

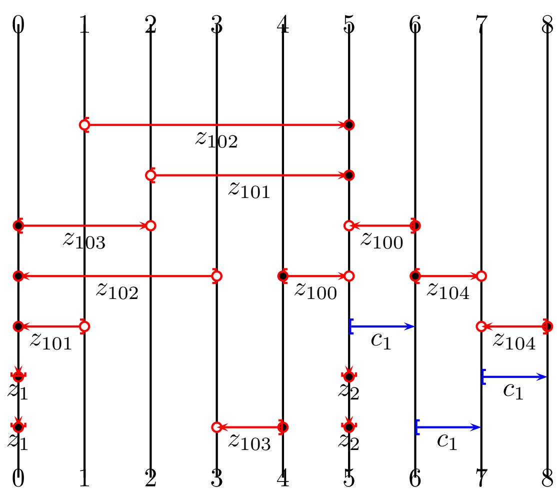
We begin from the GE root-42.2 (see pp. 179). We consider its print

```
Print 1: =0=3*<1<2<4*<5*<3=6*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 4.

Step 2: Added (new) boundary 5.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [2-3:z101+.] to (new) boundaries 5 - 8.
Step 5: Moved (old) base [0-1:z101-.] to (new) boundaries 3 - 4.
Step 6: Moved (old) base [1-3:z102+.] to (new) boundaries 4 - 8.
Step 7: Moved (old) base [0-2:z103+.] to (new) boundaries 3 - 5.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-42.2.1—is illustrated below:




**GE Information**: Carrier: [0-3:z102-.] ; Carrier Dual: [1-5:z102+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-5:z102+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-42.2.1, as derived from the application of a print to root-42.2.

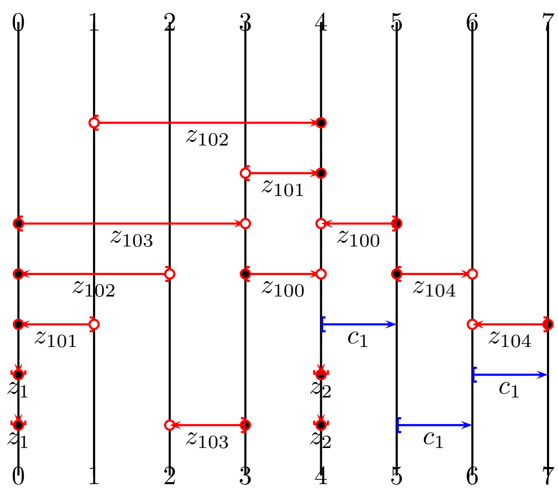
## Generalized Equation root-42.2.2

We begin from the GE root-42.2 (see pp. 179). We consider its print

```
Print 2: =0=3*<1<4*<2=5*<3=6*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 3: Moved (old) base [2-3:z101+.] to (new) boundaries 6 - 7.
Step 4: Moved (old) base [0-1:z101-.] to (new) boundaries 3 - 4.
Step 5: Moved (old) base [1-3:z102+.] to (new) boundaries 4 - 7.
Step 6: Moved (old) base [0-2:z103+.] to (new) boundaries 3 - 6.
Step 7: Collapsed (new) base [3-7:z2+.] to the empty base (7,7).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-42.2.2—is illustrated below:




**GE Information**: Carrier: [0-3:z103+.] ; Carrier Dual: [2-3:z103-.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-4:z102+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z102-.] and its dual are of opposite polarity, yet intersect. The base [0-3:z103+.] and its dual are of opposite polarity, yet intersect. The base [2-3:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-42.2.2, as derived from the application of a print to root-42.2.

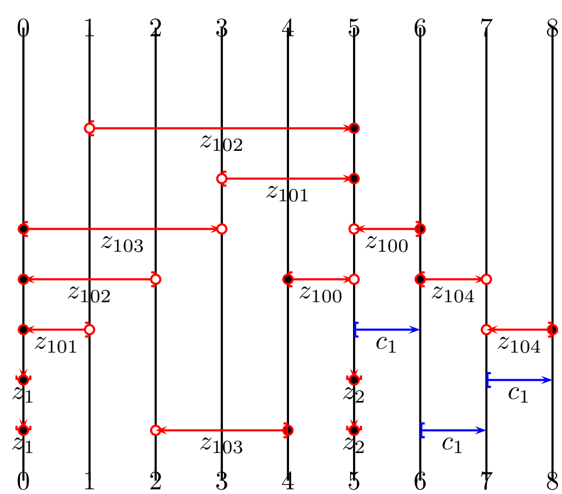
## Generalized Equation root-42.2.3

We begin from the GE root-42.2 (see pp. 179). We consider its print

```
Print 3: =0=3*<1<4*<2<5*<3=6*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [2-3:z101+.] to (new) boundaries 6 - 8.
Step 5: Moved (old) base [0-1:z101-.] to (new) boundaries 3 - 4.
Step 6: Moved (old) base [1-3:z102+.] to (new) boundaries 4 - 8.
Step 7: Moved (old) base [0-2:z103+.] to (new) boundaries 3 - 6.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-42.2.3—is illustrated below:



**GE Information**: Carrier: [0-3:z103+.] ; Carrier Dual: [2-4:z103-.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-5:z102+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z102-.] and its dual are of opposite polarity, yet intersect. The base [0-3:z103+.] and its dual are of opposite polarity, yet intersect. The base [2-4:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-42.2.3, as derived from the application of a print to root-42.2.

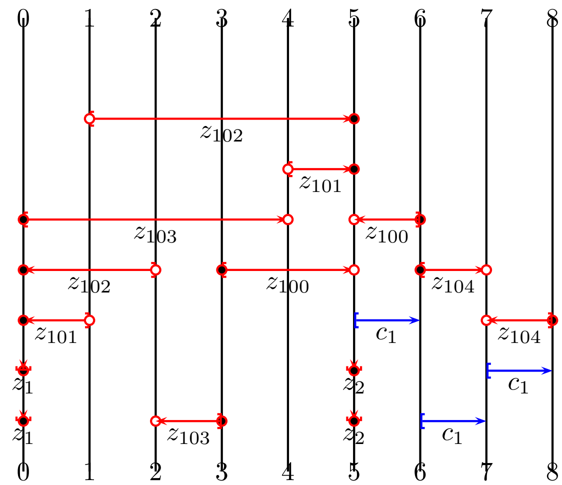
## Generalized Equation root-42.2.4

We begin from the GE root-42.2 (see pp. 179). We consider its print

```
Print 4: =0=3*<1<4*<5*<2<3=6*
```

**Sequence of actions in performing the Print 4:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [2-3:z101+.] to (new) boundaries 7 - 8.
Step 5: Moved (old) base [0-1:z101-.] to (new) boundaries 3 - 4.
Step 6: Moved (old) base [1-3:z102+.] to (new) boundaries 4 - 8.
Step 7: Moved (old) base [0-2:z103+.] to (new) boundaries 3 - 7.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-42.2.4—is illustrated below:




**GE Information**: Carrier: [0-4:z103+.] ; Carrier Dual: [2-3:z103-.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-5:z102+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z102-.] and its dual are of opposite polarity, yet intersect. The base [0-4:z103+.] and its dual are of opposite polarity, yet intersect. The base [2-3:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-42.2.4, as derived from the application of a print to root-42.2.

## Generalized Equation root-42.2.5

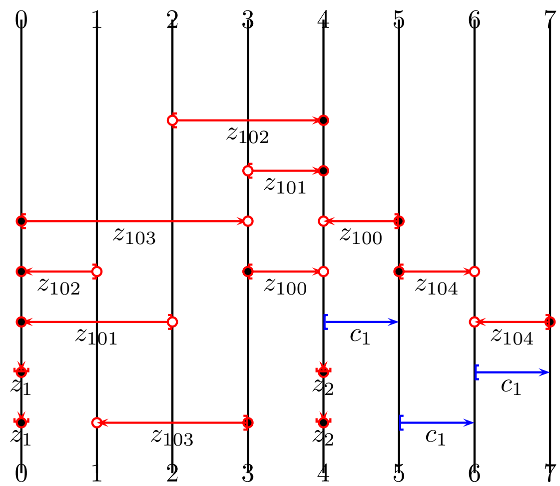
We begin from the GE root-42.2 (see pp. 179). We consider its print

```
Print 5: =0=3*<4*<1<2=5*<3=6*
```

**Sequence of actions in performing the Print 5:**
Step 1: Added (new) boundary 5.
Step 2: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 3: Moved (old) base [2-3:z101+.] to (new) boundaries 6 - 7.
Step 4: Moved (old) base [0-1:z101-.] to (new) boundaries 3 - 5.
Step 5: Moved (old) base [1-3:z102+.] to (new) boundaries 5 - 7.
Step 6: Moved (old) base [0-2:z103+.] to (new) boundaries 3 - 6.
Step 7: Collapsed (new) base [3-7:z2+.] to the empty base (7,7).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-42.2.5—is illustrated below:




**GE Information**: Carrier: [0-3:z103+.] ; Carrier Dual: [1-3:z103-.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [0-3:z103+.] and its dual are of opposite polarity, yet intersect. The base [1-3:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-42.2.5, as derived from the application of a print to root-42.2.

## Generalized Equation root-42.2.6

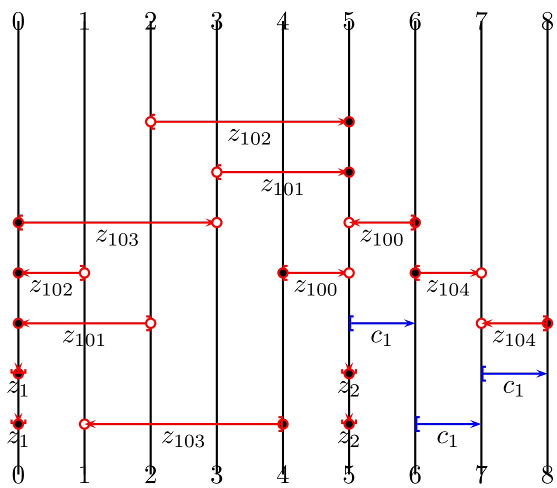
We begin from the GE root-42.2 (see pp. 179). We consider its print

```
Print 6: =0=3*<4*<1<2<5*<3=6*
```

**Sequence of actions in performing the Print 6:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [2-3:z101+.] to (new) boundaries 6 - 8.

Step 5: Moved (old) base [0-1:z101-.] to (new) boundaries 3 - 5.
Step 6: Moved (old) base [1-3:z102+.] to (new) boundaries 5 - 8.
Step 7: Moved (old) base [0-2:z103+.] to (new) boundaries 3 - 6.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-42.2.6—is illustrated below:




**GE Information**: Carrier: [0-3:z103+.] ; Carrier Dual: [1-4:z103-.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [0-3:z103+.] and its dual are of opposite polarity, yet intersect. The base [1-4:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-42.2.6, as derived from the application of a print to root-42.2.

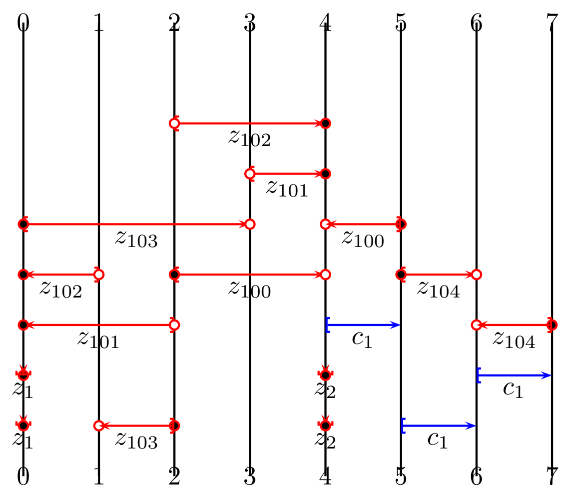
## Generalized Equation root-42.2.7

We begin from the GE root-42.2 (see pp. 179). We consider its print

```
Print 7: =0=3*<4*<1=5*<2<3=6*
```

**Sequence of actions in performing the Print 7:**
Step 1: Added (new) boundary 6.
Step 2: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 3: Moved (old) base [2-3:z101+.] to (new) boundaries 6 - 7.
Step 4: Moved (old) base [0-1:z101-.] to (new) boundaries 3 - 5.
Step 5: Moved (old) base [1-3:z102+.] to (new) boundaries 5 - 7.
Step 6: Moved (old) base [0-2:z103+.] to (new) boundaries 3 - 6.
Step 7: Collapsed (new) base [3-7:z2+.] to the empty base (7,7).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-42.2.7—is illustrated below:




**GE Information**: Carrier: [0-3:z103+.] ; Carrier Dual: [1-2:z103-.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [0-3:z103+.] and its dual are of opposite polarity, yet intersect. The base [1-2:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-42.2.7, as derived from the application of a print to root-42.2.

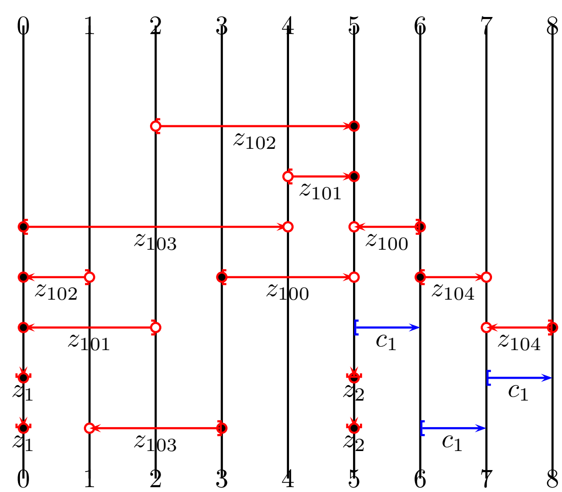
## Generalized Equation root-42.2.8

We begin from the GE root-42.2 (see pp. 179). We consider its print

```
Print 8: =0=3*<4*<1<5*<2<3=6*
```

**Sequence of actions in performing the Print 8:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [2-3:z101+.] to (new) boundaries 7 - 8.
Step 5: Moved (old) base [0-1:z101-.] to (new) boundaries 3 - 5.
Step 6: Moved (old) base [1-3:z102+.] to (new) boundaries 5 - 8.
Step 7: Moved (old) base [0-2:z103+.] to (new) boundaries 3 - 7.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-42.2.8—is illustrated below:




**GE Information**: Carrier: [0-4:z103+.] ; Carrier Dual: [1-3:z103-.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [0-4:z103+.] and its dual are of opposite polarity, yet intersect. The base [1-3:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-42.2.8, as derived from the application of a print to root-42.2.

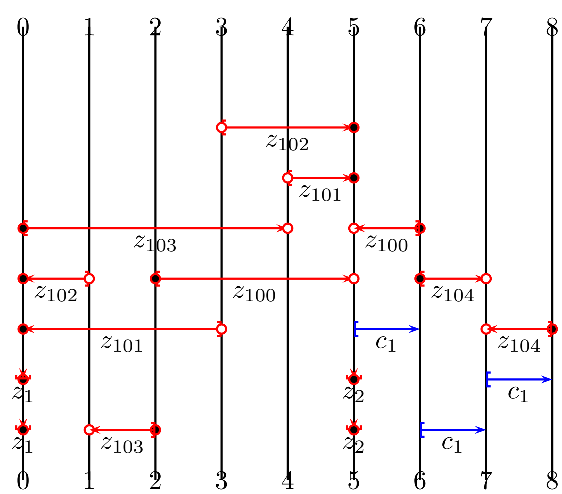
## Generalized Equation root-42.2.9

We begin from the GE root-42.2 (see pp. 179). We consider its print

```
Print 9: =0=3*<4*<5*<1<2<3=6*
```

**Sequence of actions in performing the Print 9:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [2-3:z101+.] to (new) boundaries 7 - 8.
Step 5: Moved (old) base [0-1:z101-.] to (new) boundaries 3 - 6.
Step 6: Moved (old) base [1-3:z102+.] to (new) boundaries 6 - 8.
Step 7: Moved (old) base [0-2:z103+.] to (new) boundaries 3 - 7.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-42.2.9—is illustrated below:

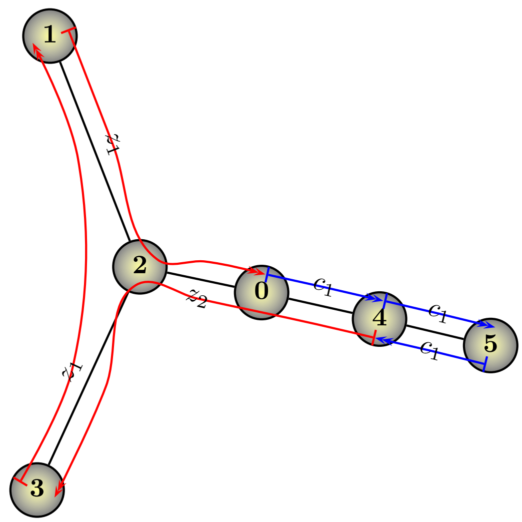


$$z_1z_1z_1c_1c_1c_1 =_F 1$$

**GE Information**: Carrier: [0-4:z103+.] ; Carrier Dual: [1-2:z103-.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [0-4:z103+.] and its dual are of opposite polarity, yet intersect. The base [1-2:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-42.2.9, as derived from the application of a print to root-42.2.

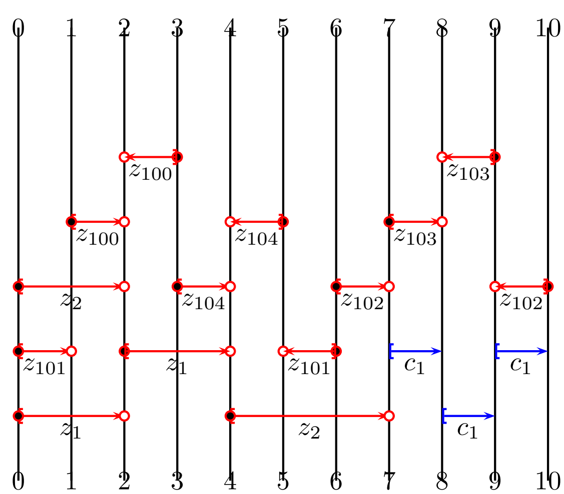
# 43 Cancellation scheme #43




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 0$ |
| $z_1$ | $3 \leftarrow 2 \leftarrow 1$ |
| $z_2$ | $4 \leftarrow 0 \leftarrow 2 \leftarrow 3$ |
| $c_1$ | $5 \leftarrow 4$ |
| $c_1$ | $4 \leftarrow 5$ |
| $c_1$ | $0 \leftarrow 4$ |

## Generalized Equation root-43

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-2:z1+.] ; Carrier Dual: [2-4:z1+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 2 valid prints (descendents).

It has 2 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1<3*<2=4*
Print 2: =0=2*<3*<1<2=4*
```

We proceed.

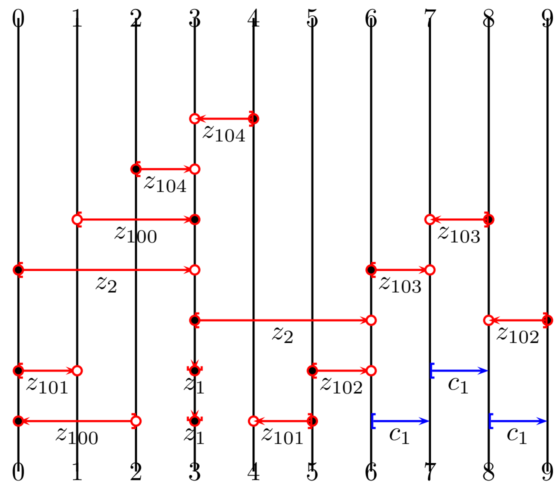
## Generalized Equation root-43.1

We begin from the GE root-43 (see pp. 192). We consider its print

```
Print 1: =0=2*<1<3*<2=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 4: Moved (old) base [1-2:z100+.] to (new) boundaries 3 - 5.
Step 5: Moved (old) base [0-1:z101+.] to (new) boundaries 2 - 3.
Step 6: Collapsed (new) base [2-5:z1+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-43.1—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-6:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [1-3:z100+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z100-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-43.1, as derived from the application of a print to root-43.

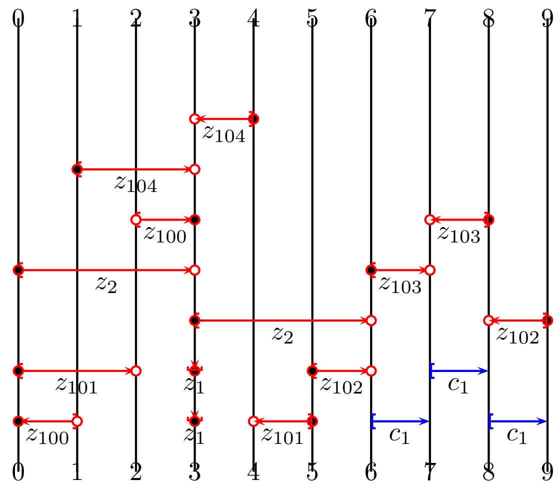
## Generalized Equation root-43.2

We begin from the GE root-43 (see pp. 192). We consider its print

```
Print 2: =0=2*<3*<1<2=4*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 4: Moved (old) base [1-2:z100+.] to (new) boundaries 4 - 5.
Step 5: Moved (old) base [0-1:z101+.] to (new) boundaries 2 - 4.
Step 6: Collapsed (new) base [2-5:z1+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-43.2—is illustrated below:



**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-6:z2+.] ; Critical Boundary: 3; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 9 valid prints (descendents).

It has 9 legal carrier-to-dual prints, as follows:

```
Print 1: =0=3*<1<2<4*<5*<3=6*
Print 2: =0=3*<1<4*<2=5*<3=6*
Print 3: =0=3*<1<4*<2<5*<3=6*
Print 4: =0=3*<1<4*<5*<2<3=6*
Print 5: =0=3*<4*<1<2=5*<3=6*
Print 6: =0=3*<4*<1<2<5*<3=6*
Print 7: =0=3*<4*<1=5*<2<3=6*
Print 8: =0=3*<4*<1<5*<2<3=6*
Print 9: =0=3*<4*<5*<1<2<3=6*
```

This completes the consideration of root-43.2, as derived from the application of a print to root-43.

## Generalized Equation root-43.2.1

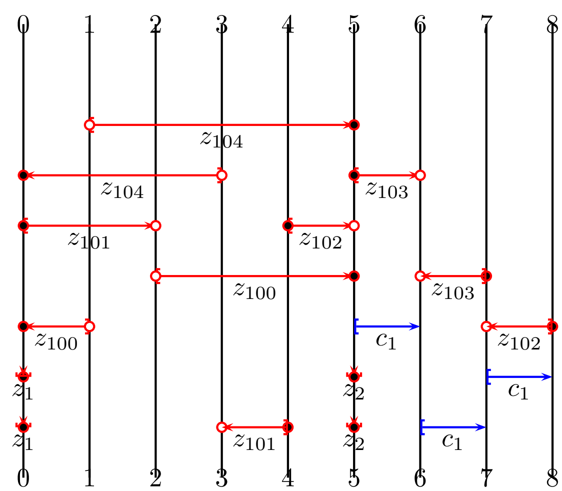
We begin from the GE root-43.2 (see pp. 194). We consider its print

```
Print 1: =0=3*<1<2<4*<5*<3=6*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 4.

Step 2: Added (new) boundary 5.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [2-3:z100+.] to (new) boundaries 5 - 8.
Step 5: Moved (old) base [0-1:z100-.] to (new) boundaries 3 - 4.
Step 6: Moved (old) base [0-2:z101+.] to (new) boundaries 3 - 5.
Step 7: Moved (old) base [1-3:z104+.] to (new) boundaries 4 - 8.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-43.2.1—is illustrated below:




**GE Information**: Carrier: [0-3:z104-.] ; Carrier Dual: [1-5:z104+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-5:z104+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-43.2.1, as derived from the application of a print to root-43.2.

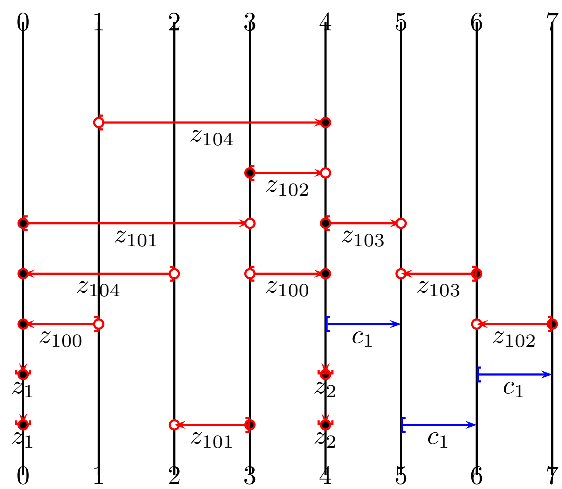
## Generalized Equation root-43.2.2

We begin from the GE root-43.2 (see pp. 194). We consider its print

```
Print 2: =0=3*<1<4*<2=5*<3=6*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 3: Moved (old) base [2-3:z100+.] to (new) boundaries 6 - 7.
Step 4: Moved (old) base [0-1:z100-.] to (new) boundaries 3 - 4.
Step 5: Moved (old) base [0-2:z101+.] to (new) boundaries 3 - 6.
Step 6: Moved (old) base [1-3:z104+.] to (new) boundaries 4 - 7.
Step 7: Collapsed (new) base [3-7:z2+.] to the empty base (7,7).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-43.2.2—is illustrated below:




**GE Information**: Carrier: [0-3:z101+.] ; Carrier Dual: [2-3:z101-.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [0-3:z101+.] and its dual are of opposite polarity, yet intersect. The base [2-3:z101-.] and its dual are of opposite polarity, yet intersect. The base [1-4:z104+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-43.2.2, as derived from the application of a print to root-43.2.

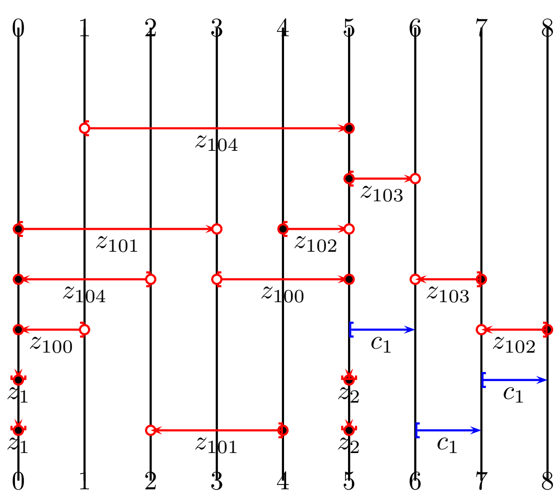
## Generalized Equation root-43.2.3

We begin from the GE root-43.2 (see pp. 194). We consider its print

```
Print 3: =0=3*<1<4*<2<5*<3=6*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [2-3:z100+.] to (new) boundaries 6 - 8.
Step 5: Moved (old) base [0-1:z100-.] to (new) boundaries 3 - 4.
Step 6: Moved (old) base [0-2:z101+.] to (new) boundaries 3 - 6.
Step 7: Moved (old) base [1-3:z104+.] to (new) boundaries 4 - 8.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-43.2.3—is illustrated below:



**GE Information**: Carrier: [0-3:z101+.] ; Carrier Dual: [2-4:z101-.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [0-3:z101+.] and its dual are of opposite polarity, yet intersect. The base [2-4:z101-.] and its dual are of opposite polarity, yet intersect. The base [1-5:z104+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-43.2.3, as derived from the application of a print to root-43.2.

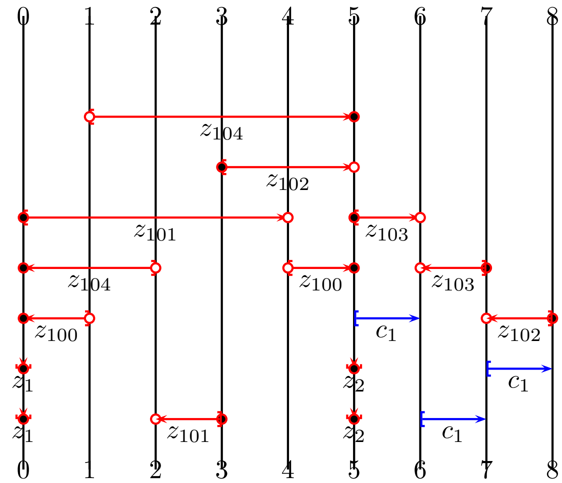
## Generalized Equation root-43.2.4

We begin from the GE root-43.2 (see pp. 194). We consider its print

```
Print 4: =0=3*<1<4*<5*<2<3=6*
```

**Sequence of actions in performing the Print 4:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [2-3:z100+.] to (new) boundaries 7 - 8.
Step 5: Moved (old) base [0-1:z100-.] to (new) boundaries 3 - 4.
Step 6: Moved (old) base [0-2:z101+.] to (new) boundaries 3 - 7.
Step 7: Moved (old) base [1-3:z104+.] to (new) boundaries 4 - 8.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-43.2.4—is illustrated below:




**GE Information**: Carrier: [0-4:z101+.] ; Carrier Dual: [2-3:z101-.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [0-4:z101+.] and its dual are of opposite polarity, yet intersect. The base [2-3:z101-.] and its dual are of opposite polarity, yet intersect. The base [1-5:z104+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-43.2.4, as derived from the application of a print to root-43.2.

## Generalized Equation root-43.2.5

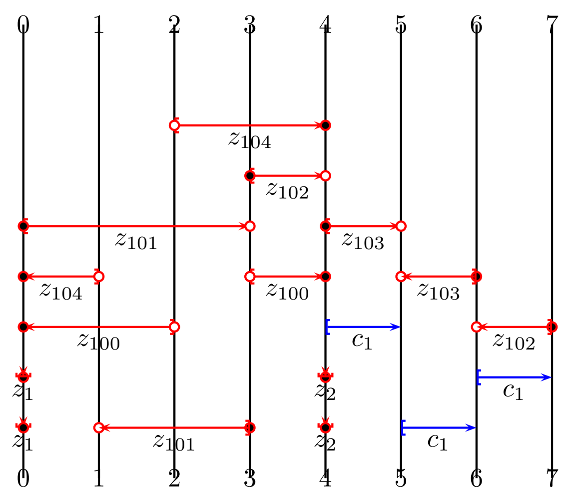
We begin from the GE root-43.2 (see pp. 194). We consider its print

```
Print 5: =0=3*<4*<1<2=5*<3=6*
```

**Sequence of actions in performing the Print 5:**
Step 1: Added (new) boundary 5.
Step 2: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 3: Moved (old) base [2-3:z100+.] to (new) boundaries 6 - 7.
Step 4: Moved (old) base [0-1:z100-.] to (new) boundaries 3 - 5.
Step 5: Moved (old) base [0-2:z101+.] to (new) boundaries 3 - 6.
Step 6: Moved (old) base [1-3:z104+.] to (new) boundaries 5 - 7.
Step 7: Collapsed (new) base [3-7:z2+.] to the empty base (7,7).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-43.2.5—is illustrated below:




**GE Information**: Carrier: [0-3:z101+.] ; Carrier Dual: [1-3:z101-.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [0-3:z101+.] and its dual are of opposite polarity, yet intersect. The base [1-3:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-43.2.5, as derived from the application of a print to root-43.2.

## Generalized Equation root-43.2.6

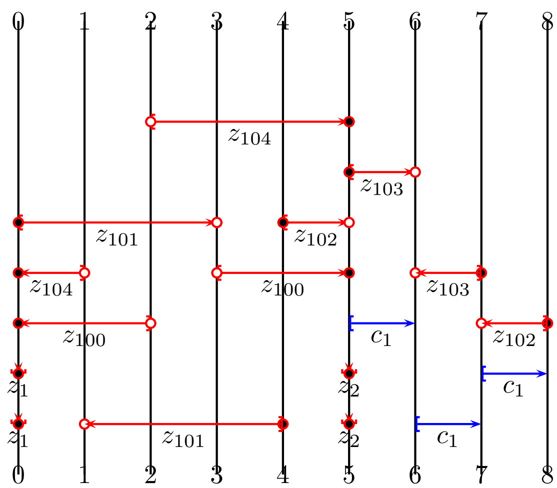
We begin from the GE root-43.2 (see pp. 194). We consider its print

```
Print 6: =0=3*<4*<1<2<5*<3=6*
```

**Sequence of actions in performing the Print 6:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [2-3:z100+.] to (new) boundaries 6 - 8.

Step 5: Moved (old) base [0-1:z100-.] to (new) boundaries 3 - 5.
Step 6: Moved (old) base [0-2:z101+.] to (new) boundaries 3 - 6.
Step 7: Moved (old) base [1-3:z104+.] to (new) boundaries 5 - 8.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-43.2.6—is illustrated below:




**GE Information**: Carrier: [0-3:z101+.] ; Carrier Dual: [1-4:z101-.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [0-3:z101+.] and its dual are of opposite polarity, yet intersect. The base [1-4:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-43.2.6, as derived from the application of a print to root-43.2.

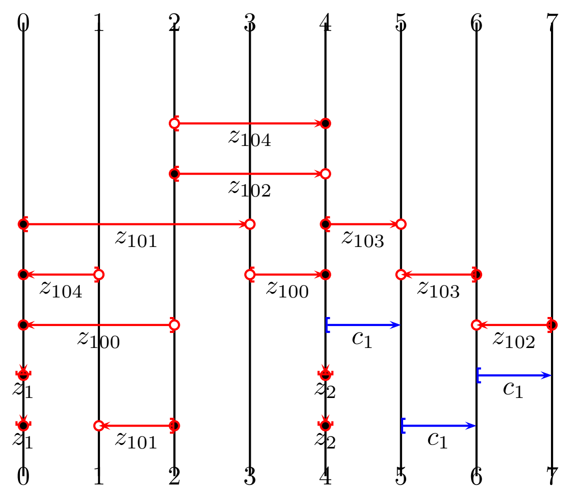
## Generalized Equation root-43.2.7

We begin from the GE root-43.2 (see pp. 194). We consider its print

```
Print 7: =0=3*<4*<1=5*<2<3=6*
```

**Sequence of actions in performing the Print 7:**
Step 1: Added (new) boundary 6.
Step 2: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 3: Moved (old) base [2-3:z100+.] to (new) boundaries 6 - 7.
Step 4: Moved (old) base [0-1:z100-.] to (new) boundaries 3 - 5.
Step 5: Moved (old) base [0-2:z101+.] to (new) boundaries 3 - 6.
Step 6: Moved (old) base [1-3:z104+.] to (new) boundaries 5 - 7.
Step 7: Collapsed (new) base [3-7:z2+.] to the empty base (7,7).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-43.2.7—is illustrated below:




**GE Information**: Carrier: [0-3:z101+.] ; Carrier Dual: [1-2:z101-.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [0-3:z101+.] and its dual are of opposite polarity, yet intersect. The base [1-2:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-43.2.7, as derived from the application of a print to root-43.2.

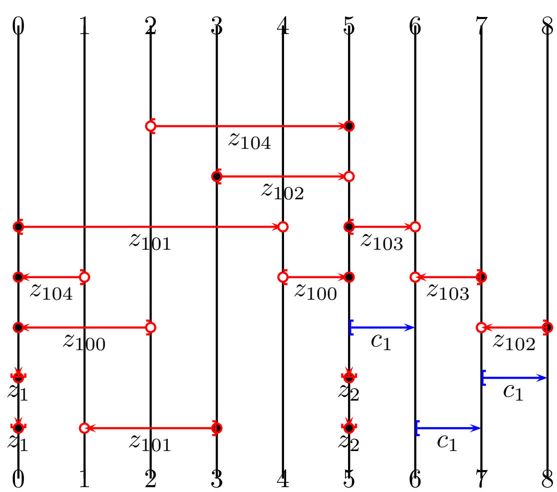
## Generalized Equation root-43.2.8

We begin from the GE root-43.2 (see pp. 194). We consider its print

```
Print 8: =0=3*<4*<1<5*<2<3=6*
```

**Sequence of actions in performing the Print 8:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [2-3:z100+.] to (new) boundaries 7 - 8.
Step 5: Moved (old) base [0-1:z100-.] to (new) boundaries 3 - 5.
Step 6: Moved (old) base [0-2:z101+.] to (new) boundaries 3 - 7.
Step 7: Moved (old) base [1-3:z104+.] to (new) boundaries 5 - 8.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-43.2.8—is illustrated below:




**GE Information**: Carrier: [0-4:z101+.] ; Carrier Dual: [1-3:z101-.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [0-4:z101+.] and its dual are of opposite polarity, yet intersect. The base [1-3:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-43.2.8, as derived from the application of a print to root-43.2.

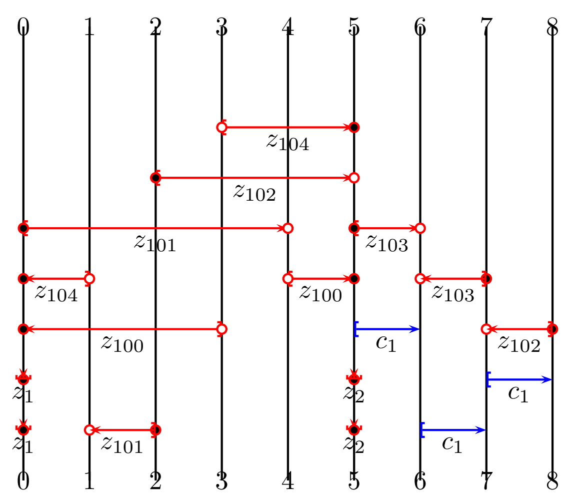
## Generalized Equation root-43.2.9

We begin from the GE root-43.2 (see pp. 194). We consider its print

```
Print 9: =0=3*<4*<5*<1<2<3=6*
```

**Sequence of actions in performing the Print 9:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [2-3:z100+.] to (new) boundaries 7 - 8.
Step 5: Moved (old) base [0-1:z100-.] to (new) boundaries 3 - 6.
Step 6: Moved (old) base [0-2:z101+.] to (new) boundaries 3 - 7.
Step 7: Moved (old) base [1-3:z104+.] to (new) boundaries 6 - 8.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

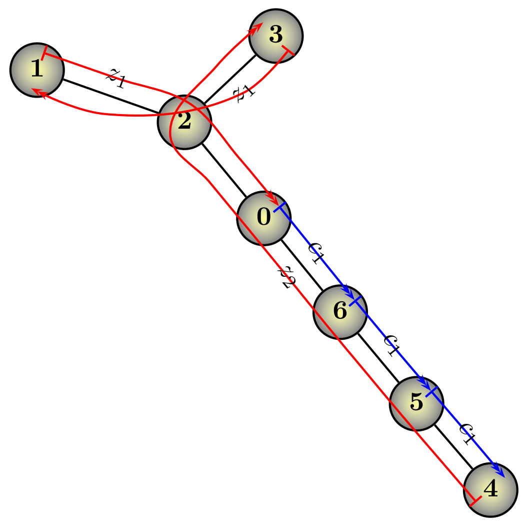
Upon applying the print, the GE we obtain—which we refer to as root-43.2.9—is illustrated below:



**GE Information**: Carrier: [0-4:z101+.] ; Carrier Dual: [1-2:z101-.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [0-4:z101+.] and its dual are of opposite polarity, yet intersect. The base [1-2:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-43.2.9, as derived from the application of a print to root-43.2.

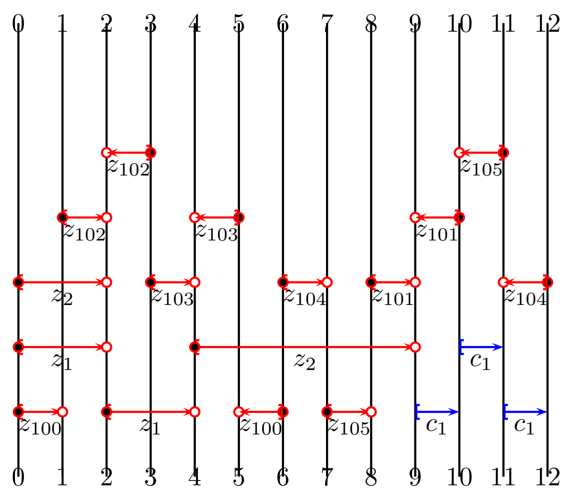
# 44 Cancellation scheme #44




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 0$ |
| $z_1$ | $3 \leftarrow 2 \leftarrow 1$ |
| $z_2$ | $4 \leftarrow 5 \leftarrow 6 \leftarrow 0 \leftarrow 2 \leftarrow 3$ |
| $c_1$ | $5 \leftarrow 4$ |
| $c_1$ | $6 \leftarrow 5$ |
| $c_1$ | $0 \leftarrow 6$ |

## Generalized Equation root-44

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-2:z1+.] ; Carrier Dual: [2-4:z1+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 2 valid prints (descendents).

It has 2 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1<3*<2=4*
Print 2: =0=2*<3*<1<2=4*
```

We proceed.

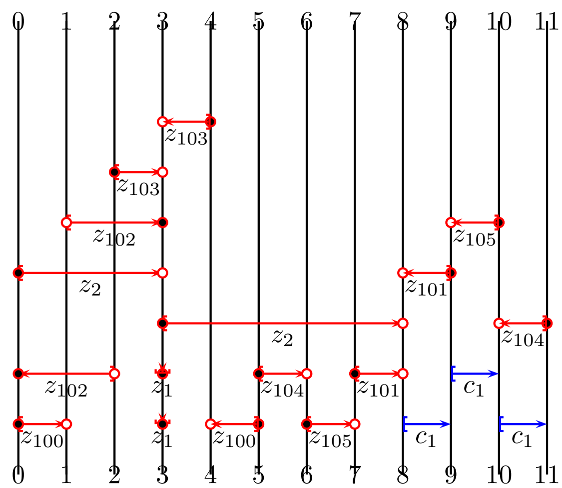
## Generalized Equation root-44.1

We begin from the GE root-44 (see pp. 207). We consider its print

```
Print 1: =0=2*<1<3*<2=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 4: Moved (old) base [0-1:z100+.] to (new) boundaries 2 - 3.
Step 5: Moved (old) base [1-2:z102+.] to (new) boundaries 3 - 5.
Step 6: Collapsed (new) base [2-5:z1+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-44.1—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-8:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [1-3:z102+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-44.1, as derived from the application of a print to root-44.

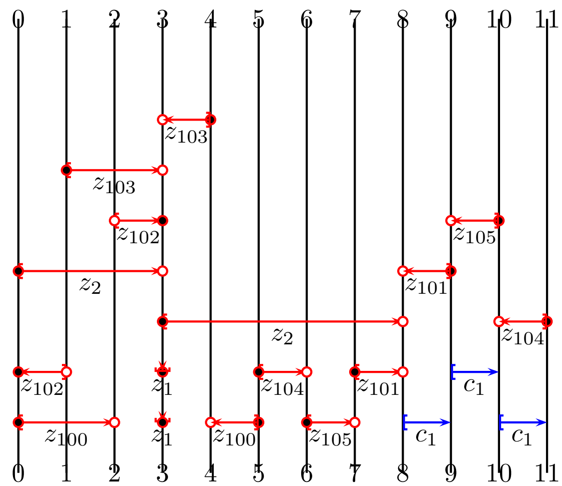
## Generalized Equation root-44.2

We begin from the GE root-44 (see pp. 207). We consider its print

```
Print 2: =0=2*<3*<1<2=4*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 4: Moved (old) base [0-1:z100+.] to (new) boundaries 2 - 4.
Step 5: Moved (old) base [1-2:z102+.] to (new) boundaries 4 - 5.
Step 6: Collapsed (new) base [2-5:z1+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-44.2—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-8:z2+.] ; Critical Boundary: 3; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 33 valid prints (descendents).

It has 33 legal carrier-to-dual prints, as follows:

```
Print 1: =0=3*<1<2<4*<5*<6*<7*<3=8*
Print 2: =0=3*<1<4*<2=5*<6*<7*<3=8*
Print 3: =0=3*<1<4*<2<5*<6*<7*<3=8*
Print 4: =0=3*<1<4*<5*<2=6*<7*<3=8*
Print 5: =0=3*<1<4*<5*<2<6*<7*<3=8*
Print 6: =0=3*<1<4*<5*<6*<2=7*<3=8*
Print 7: =0=3*<1<4*<5*<6*<2<7*<3=8*
Print 8: =0=3*<1<4*<5*<6*<7*<2<3=8*
Print 9: =0=3*<4*<1<2=5*<6*<7*<3=8*
Print 10: =0=3*<4*<1<2<5*<6*<7*<3=8*
Print 11: =0=3*<4*<1=5*<2=6*<7*<3=8*
Print 12: =0=3*<4*<1=5*<2<6*<7*<3=8*
Print 13: =0=3*<4*<1=5*<6*<2=7*<3=8*
Print 14: =0=3*<4*<1=5*<6*<2<7*<3=8*
Print 15: =0=3*<4*<1=5*<6*<7*<2<3=8*
Print 16: =0=3*<4*<1<5*<2=6*<7*<3=8*
Print 17: =0=3*<4*<1<5*<2<6*<7*<3=8*
Print 18: =0=3*<4*<1<5*<6*<2=7*<3=8*
Print 19: =0=3*<4*<1<5*<6*<2<7*<3=8*
Print 20: =0=3*<4*<1<5*<6*<7*<2<3=8*
Print 21: =0=3*<4*<5*<1<2=6*<7*<3=8*
```

```
Print 22: =0=3*<4*<5*<1<2<6*<7*<3=8*
Print 23: =0=3*<4*<5*<1=6*<2=7*<3=8*
Print 24: =0=3*<4*<5*<1=6*<2<7*<3=8*
Print 25: =0=3*<4*<5*<1=6*<7*<2<3=8*
Print 26: =0=3*<4*<5*<1<6*<2=7*<3=8*
Print 27: =0=3*<4*<5*<1<6*<2<7*<3=8*
Print 28: =0=3*<4*<5*<1<6*<7*<2<3=8*
Print 29: =0=3*<4*<5*<6*<1<2=7*<3=8*
Print 30: =0=3*<4*<5*<6*<1<2<7*<3=8*
Print 31: =0=3*<4*<5*<6*<1=7*<2<3=8*
Print 32: =0=3*<4*<5*<6*<1<7*<2<3=8*
Print 33: =0=3*<4*<5*<6*<7*<1<2<3=8*
```

This completes the consideration of root-44.2, as derived from the application of a print to root-44.

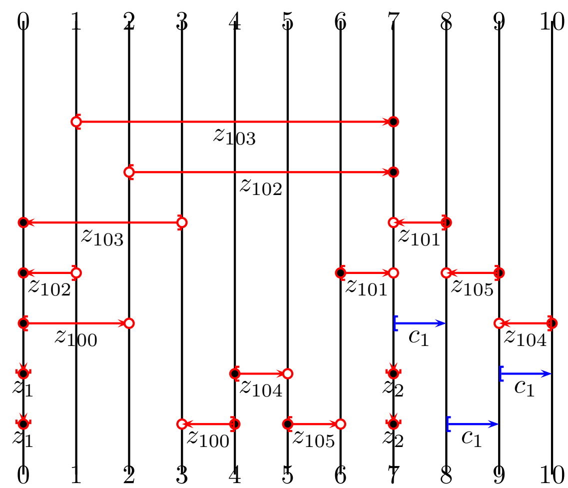
## Generalized Equation root-44.2.1

We begin from the GE root-44.2 (see pp. 209). We consider its print

```
Print 1: =0=3*<1<2<4*<5*<6*<7*<3=8*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 5.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 10.
Step 4: Moved (old) base [0-2:z100+.] to (new) boundaries 3 - 5.
Step 5: Moved (old) base [2-3:z102+.] to (new) boundaries 5 - 10.
Step 6: Moved (old) base [0-1:z102-.] to (new) boundaries 3 - 4.
Step 7: Moved (old) base [1-3:z103+.] to (new) boundaries 4 - 10.
Step 8: Collapsed (new) base [3-10:z2+.] to the empty base (10,10).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-44.2.1—is illustrated below:




**GE Information**: Carrier: [0-3:z103-.] ; Carrier Dual: [1-7:z103+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-7:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-44.2.1, as derived from the application of a print to root-44.2.

## Generalized Equation root-44.2.2

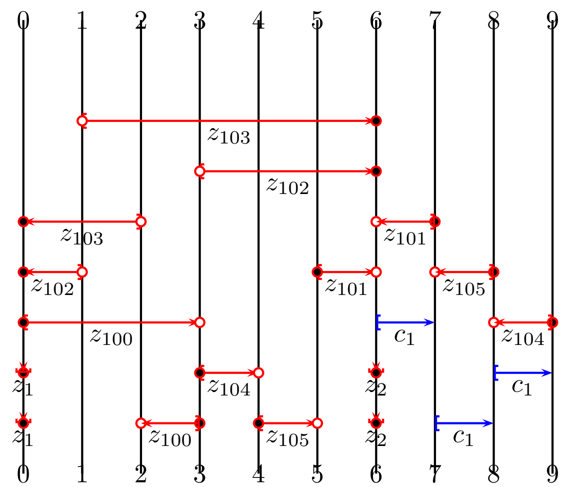
We begin from the GE root-44.2 (see pp. 209). We consider its print

```
Print 2: =0=3*<1<4*<2=5*<6*<7*<3=8*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 9.
Step 3: Moved (old) base [0-2:z100+.] to (new) boundaries 3 - 6.
Step 4: Moved (old) base [2-3:z102+.] to (new) boundaries 6 - 9.
Step 5: Moved (old) base [0-1:z102-.] to (new) boundaries 3 - 4.
Step 6: Moved (old) base [1-3:z103+.] to (new) boundaries 4 - 9.
Step 7: Collapsed (new) base [3-9:z2+.] to the empty base (9,9).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-44.2.2—is illustrated below:




**GE Information**: Carrier: [0-3:z100+.] ; Carrier Dual: [2-3:z100-.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [0-3:z100+.] and its dual are of opposite polarity, yet intersect. The base [2-3:z100-.] and its dual are of opposite polarity, yet intersect. The base [1-6:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-44.2.2, as derived from the application of a print to root-44.2.

## Generalized Equation root-44.2.3

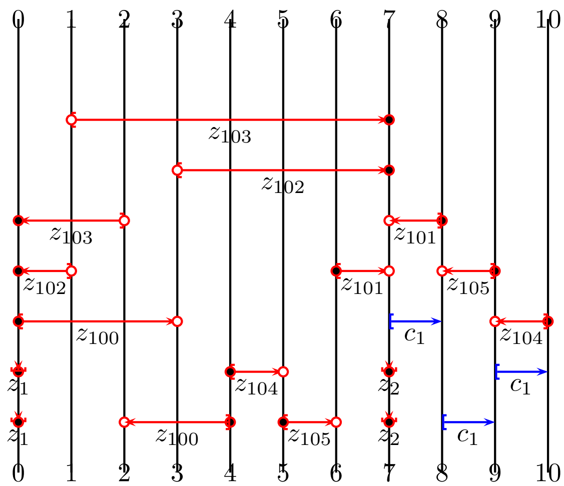
We begin from the GE root-44.2 (see pp. 209). We consider its print

```
Print 3: =0=3*<1<4*<2<5*<6*<7*<3=8*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 10.
Step 4: Moved (old) base [0-2:z100+.] to (new) boundaries 3 - 6.

Step 5: Moved (old) base [2-3:z102+.] to (new) boundaries 6 - 10.
Step 6: Moved (old) base [0-1:z102-.] to (new) boundaries 3 - 4.
Step 7: Moved (old) base [1-3:z103+.] to (new) boundaries 4 - 10.
Step 8: Collapsed (new) base [3-10:z2+.] to the empty base (10,10).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-44.2.3—is illustrated below:




**GE Information**: Carrier: [0-3:z100+.] ; Carrier Dual: [2-4:z100-.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [0-3:z100+.] and its dual are of opposite polarity, yet intersect. The base [2-4:z100-.] and its dual are of opposite polarity, yet intersect. The base [1-7:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-44.2.3, as derived from the application of a print to root-44.2.

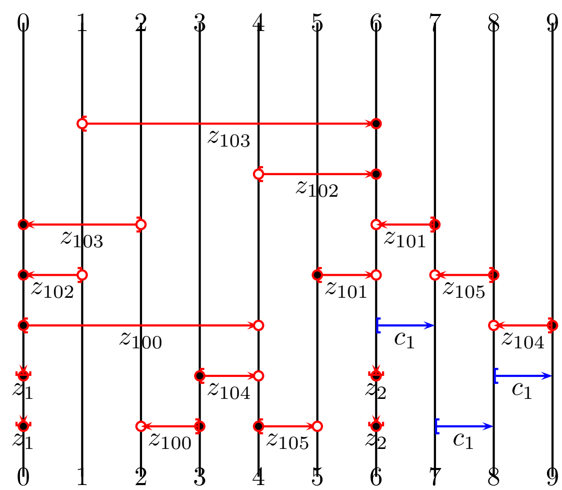
## Generalized Equation root-44.2.4

We begin from the GE root-44.2 (see pp. 209). We consider its print

```
Print 4: =0=3*<1<4*<5*<2=6*<7*<3=8*
```

**Sequence of actions in performing the Print 4:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 9.
Step 3: Moved (old) base [0-2:z100+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [2-3:z102+.] to (new) boundaries 7 - 9.
Step 5: Moved (old) base [0-1:z102-.] to (new) boundaries 3 - 4.
Step 6: Moved (old) base [1-3:z103+.] to (new) boundaries 4 - 9.
Step 7: Collapsed (new) base [3-9:z2+.] to the empty base (9,9).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-44.2.4—is illustrated below:




**GE Information**: Carrier: [0-4:z100+.] ; Carrier Dual: [2-3:z100-.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [0-4:z100+.] and its dual are of opposite polarity, yet intersect. The base [2-3:z100-.] and its dual are of opposite polarity, yet intersect. The base [1-6:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-44.2.4, as derived from the application

of a print to root-44.2.

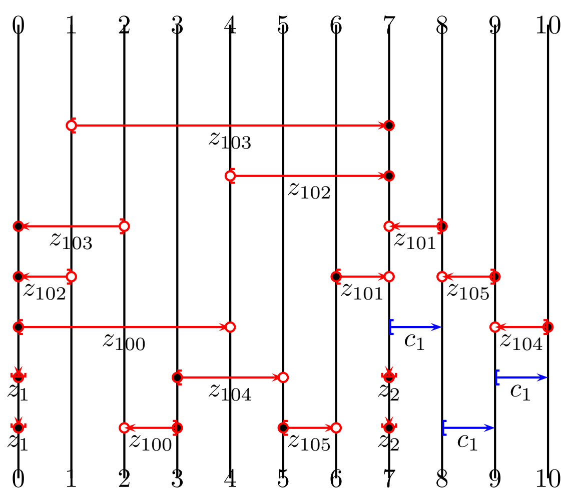
## Generalized Equation root-44.2.5

We begin from the GE root-44.2 (see pp. 209). We consider its print

```
Print 5: =0=3*<1<4*<5*<2<6*<7*<3=8*
```

**Sequence of actions in performing the Print 5:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 10.
Step 4: Moved (old) base [0-2:z100+.] to (new) boundaries 3 - 7.
Step 5: Moved (old) base [2-3:z102+.] to (new) boundaries 7 - 10.
Step 6: Moved (old) base [0-1:z102-.] to (new) boundaries 3 - 4.
Step 7: Moved (old) base [1-3:z103+.] to (new) boundaries 4 - 10.
Step 8: Collapsed (new) base [3-10:z2+.] to the empty base (10,10).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-44.2.5—is illustrated below:




**GE Information**: Carrier: [0-4:z100+.] ; Carrier Dual: [2-3:z100-.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [0-4:z100+.]

and its dual are of opposite polarity, yet intersect. The base [2-3:z100-.] and its dual are of opposite polarity, yet intersect. The base [1-7:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-44.2.5, as derived from the application of a print to root-44.2.

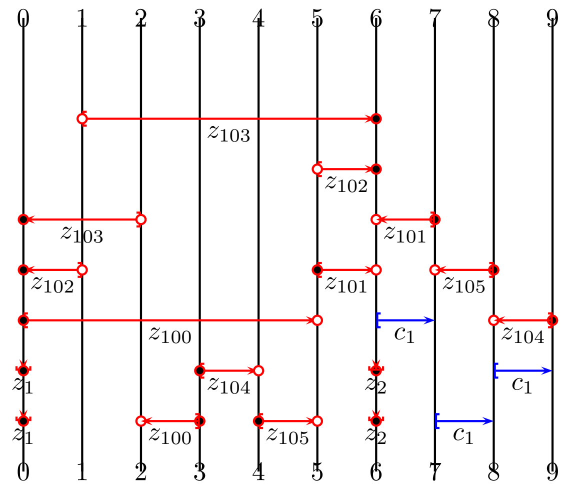
## Generalized Equation root-44.2.6

We begin from the GE root-44.2 (see pp. 209). We consider its print

```
Print 6: =0=3*<1<4*<5*<6*<2=7*<3=8*
```

**Sequence of actions in performing the Print 6:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 9.
Step 3: Moved (old) base [0-2:z100+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [2-3:z102+.] to (new) boundaries 8 - 9.
Step 5: Moved (old) base [0-1:z102-.] to (new) boundaries 3 - 4.
Step 6: Moved (old) base [1-3:z103+.] to (new) boundaries 4 - 9.
Step 7: Collapsed (new) base [3-9:z2+.] to the empty base (9,9).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-44.2.6—is illustrated below:




**GE Information**: Carrier: [0-5:z100+.] ; Carrier Dual: [2-3:z100-.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [0-5:z100+.] and its dual are of opposite polarity, yet intersect. The base [2-3:z100-.] and its dual are of opposite polarity, yet intersect. The base [1-6:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-44.2.6, as derived from the application of a print to root-44.2.

## Generalized Equation root-44.2.7

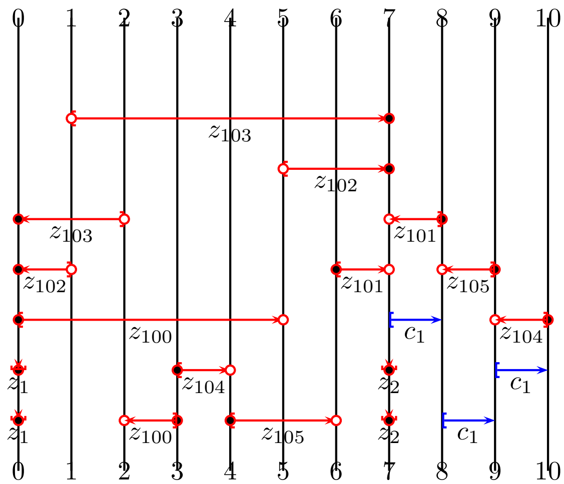
We begin from the GE root-44.2 (see pp. 209). We consider its print

```
Print 7: =0=3*<1<4*<5*<6*<2<7*<3=8*
```

**Sequence of actions in performing the Print 7:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 8.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 10.
Step 4: Moved (old) base [0-2:z100+.] to (new) boundaries 3 - 8.
Step 5: Moved (old) base [2-3:z102+.] to (new) boundaries 8 - 10.
Step 6: Moved (old) base [0-1:z102-.] to (new) boundaries 3 - 4.
Step 7: Moved (old) base [1-3:z103+.] to (new) boundaries 4 - 10.
Step 8: Collapsed (new) base [3-10:z2+.] to the empty base (10,10).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This

will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-44.2.7—is illustrated below:




**GE Information**: Carrier: [0-5:z100+.] ; Carrier Dual: [2-3:z100-.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [0-5:z100+.] and its dual are of opposite polarity, yet intersect. The base [2-3:z100-.] and its dual are of opposite polarity, yet intersect. The base [1-7:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-44.2.7, as derived from the application of a print to root-44.2.

## Generalized Equation root-44.2.8

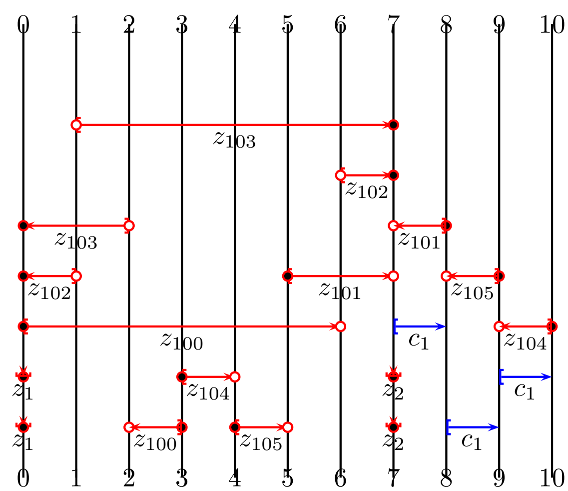
We begin from the GE root-44.2 (see pp. 209). We consider its print

```
Print 8: =0=3*<1<4*<5*<6*<7*<2<3=8*
```

**Sequence of actions in performing the Print 8:**
Step 1: Added (new) boundary 4.

Step 2: Added (new) boundary 9.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 10.
Step 4: Moved (old) base [0-2:z100+.] to (new) boundaries 3 - 9.
Step 5: Moved (old) base [2-3:z102+.] to (new) boundaries 9 - 10.
Step 6: Moved (old) base [0-1:z102-.] to (new) boundaries 3 - 4.
Step 7: Moved (old) base [1-3:z103+.] to (new) boundaries 4 - 10.
Step 8: Collapsed (new) base [3-10:z2+.] to the empty base (10,10).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-44.2.8—is illustrated below:




**GE Information**: Carrier: [0-6:z100+.] ; Carrier Dual: [2-3:z100-.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [0-6:z100+.] and its dual are of opposite polarity, yet intersect. The base [2-3:z100-.] and its dual are of opposite polarity, yet intersect. The base [1-7:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-44.2.8, as derived from the application of a print to root-44.2.

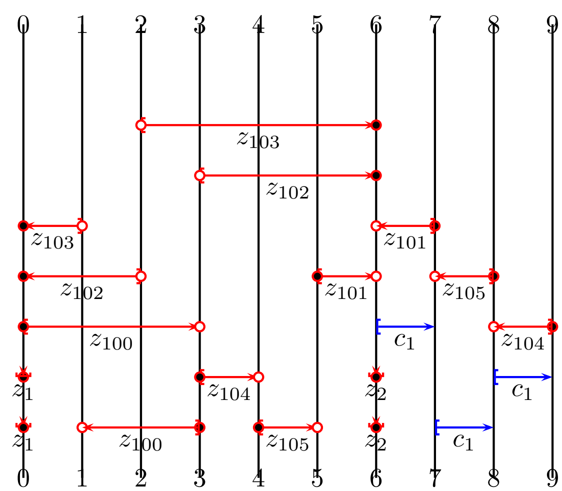
## Generalized Equation root-44.2.9

We begin from the GE root-44.2 (see pp. 209). We consider its print

```
Print 9: =0=3*<4*<1<2=5*<6*<7*<3=8*
```

**Sequence of actions in performing the Print 9:**
Step 1: Added (new) boundary 5.
Step 2: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 9.
Step 3: Moved (old) base [0-2:z100+.] to (new) boundaries 3 - 6.
Step 4: Moved (old) base [2-3:z102+.] to (new) boundaries 6 - 9.
Step 5: Moved (old) base [0-1:z102-.] to (new) boundaries 3 - 5.
Step 6: Moved (old) base [1-3:z103+.] to (new) boundaries 5 - 9.
Step 7: Collapsed (new) base [3-9:z2+.] to the empty base (9,9).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-44.2.9—is illustrated below:




**GE Information**: Carrier: [0-3:z100+.] ; Carrier Dual: [1-3:z100-.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [0-3:z100+.] and its dual are of opposite polarity, yet intersect. The base [1-3:z100-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-44.2.9, as derived from the application of a print to root-44.2.

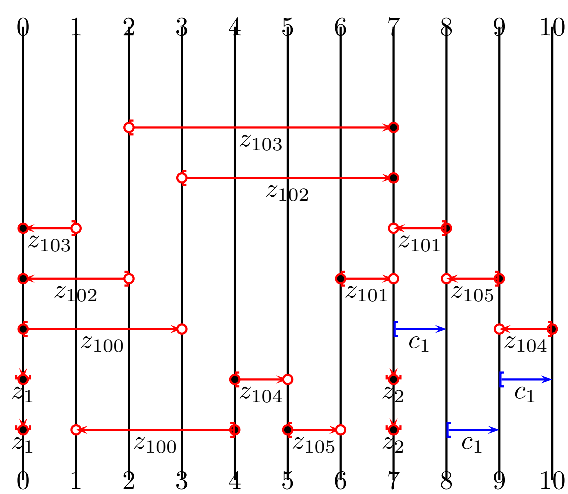
## Generalized Equation root-44.2.10

We begin from the GE root-44.2 (see pp. 209). We consider its print

```
Print 10: =0=3*<4*<1<2<5*<6*<7*<3=8*
```

**Sequence of actions in performing the Print 10:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 10.
Step 4: Moved (old) base [0-2:z100+.] to (new) boundaries 3 - 6.
Step 5: Moved (old) base [2-3:z102+.] to (new) boundaries 6 - 10.
Step 6: Moved (old) base [0-1:z102-.] to (new) boundaries 3 - 5.
Step 7: Moved (old) base [1-3:z103+.] to (new) boundaries 5 - 10.
Step 8: Collapsed (new) base [3-10:z2+.] to the empty base (10,10).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-44.2.10—is illustrated below:



**GE Information**: Carrier: [0-3:z100+.] ; Carrier Dual: [1-4:z100-.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [0-3:z100+.] and its dual are of opposite polarity, yet intersect. The base [1-4:z100-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-44.2.10, as derived from the application of a print to root-44.2.

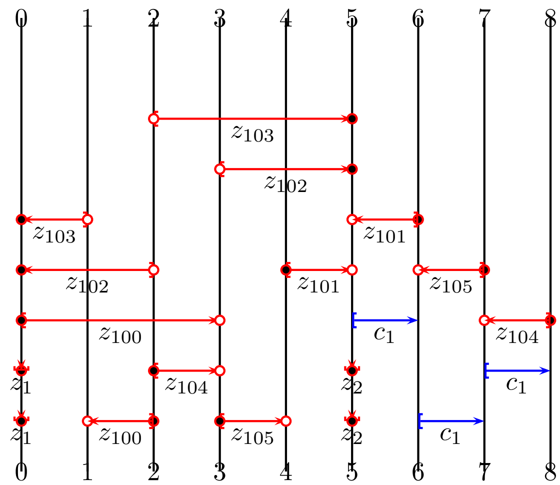
## Generalized Equation root-44.2.11

We begin from the GE root-44.2 (see pp. 209). We consider its print

```
Print 11: =0=3*<4*<1=5*<2=6*<7*<3=8*
```

**Sequence of actions in performing the Print 11:**
Step 1: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 2: Moved (old) base [0-2:z100+.] to (new) boundaries 3 - 6.
Step 3: Moved (old) base [2-3:z102+.] to (new) boundaries 6 - 8.
Step 4: Moved (old) base [0-1:z102-.] to (new) boundaries 3 - 5.
Step 5: Moved (old) base [1-3:z103+.] to (new) boundaries 5 - 8.
Step 6: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-44.2.11—is illustrated below:




**GE Information**: Carrier: [0-3:z100+.] ; Carrier Dual: [1-2:z100-.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [0-3:z100+.] and its dual are of opposite polarity, yet intersect. The base [1-2:z100-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-44.2.11, as derived from the application of a print to root-44.2.

## Generalized Equation root-44.2.12

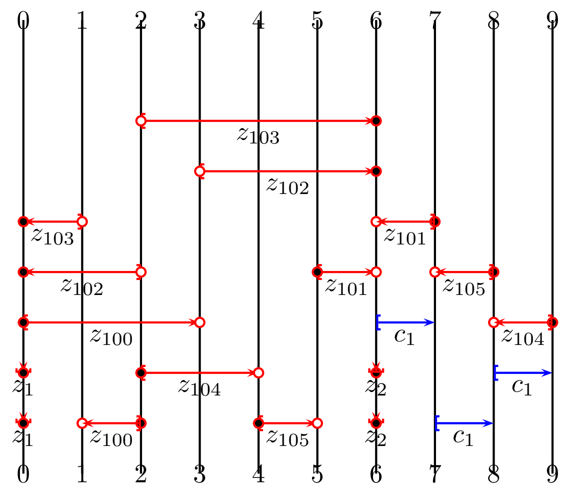
We begin from the GE root-44.2 (see pp. 209). We consider its print

```
Print 12: =0=3*<4*<1=5*<2<6*<7*<3=8*
```

**Sequence of actions in performing the Print 12:**
Step 1: Added (new) boundary 6.
Step 2: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 9.
Step 3: Moved (old) base [0-2:z100+.] to (new) boundaries 3 - 6.
Step 4: Moved (old) base [2-3:z102+.] to (new) boundaries 6 - 9.
Step 5: Moved (old) base [0-1:z102-.] to (new) boundaries 3 - 5.
Step 6: Moved (old) base [1-3:z103+.] to (new) boundaries 5 - 9.
Step 7: Collapsed (new) base [3-9:z2+.] to the empty base (9,9).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-44.2.12—is illustrated below:



**GE Information**: Carrier: [0-3:z100+.] ; Carrier Dual: [1-2:z100-.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [0-3:z100+.] and its dual are of opposite polarity, yet intersect. The base [1-2:z100-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-44.2.12, as derived from the application of a print to root-44.2.

## Generalized Equation root-44.2.13

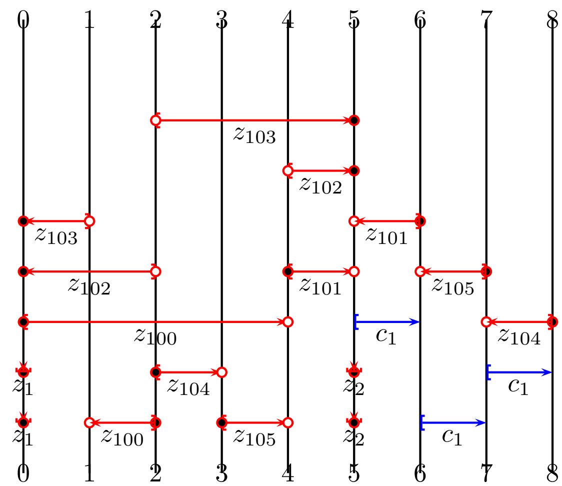
We begin from the GE root-44.2 (see pp. 209). We consider its print

```
Print 13: =0=3*<4*<1=5*<6*<2=7*<3=8*
```

**Sequence of actions in performing the Print 13:**
Step 1: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 2: Moved (old) base [0-2:z100+.] to (new) boundaries 3 - 7.
Step 3: Moved (old) base [2-3:z102+.] to (new) boundaries 7 - 8.
Step 4: Moved (old) base [0-1:z102-.] to (new) boundaries 3 - 5.
Step 5: Moved (old) base [1-3:z103+.] to (new) boundaries 5 - 8.
Step 6: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).

Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

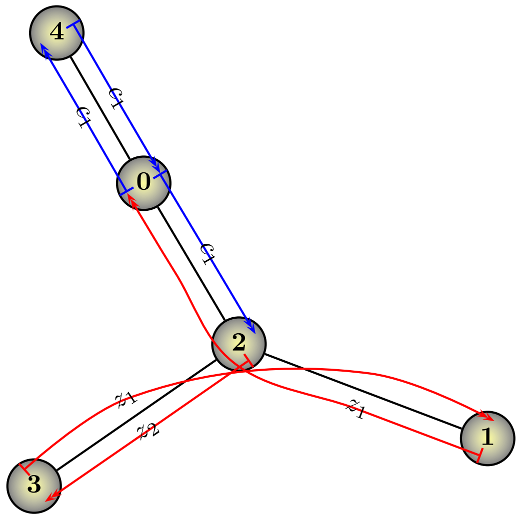
Upon applying the print, the GE we obtain—which we refer to as root-44.2.13—is illustrated below:




**GE Information**: Carrier: [0-4:z100+.] ; Carrier Dual: [1-2:z100-.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [0-4:z100+.] and its dual are of opposite polarity, yet intersect. The base [1-2:z100-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-44.2.13, as derived from the application of a print to root-44.2.

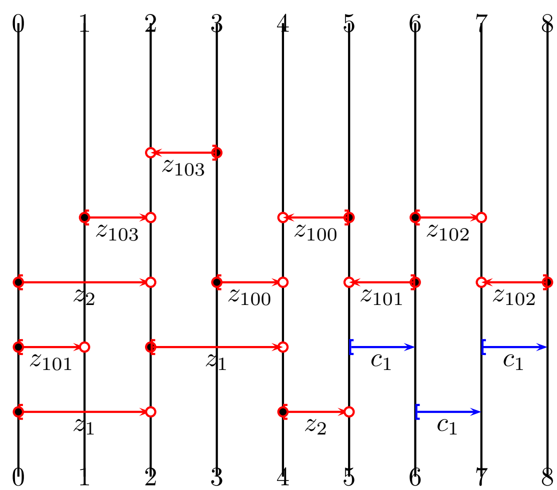
# 45 Cancellation scheme #45




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 0$ |
| $z_1$ | $3 \leftarrow 2 \leftarrow 1$ |
| $z_2$ | $2 \leftarrow 3$ |
| $c_1$ | $0 \leftarrow 2$ |
| $c_1$ | $4 \leftarrow 0$ |
| $c_1$ | $0 \leftarrow 4$ |

## Generalized Equation root-45

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-2:z1+.] ; Carrier Dual: [2-4:z1+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 2 valid prints (descendents).

It has 2 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1<3*<2=4*
Print 2: =0=2*<3*<1<2=4*
```

We proceed.

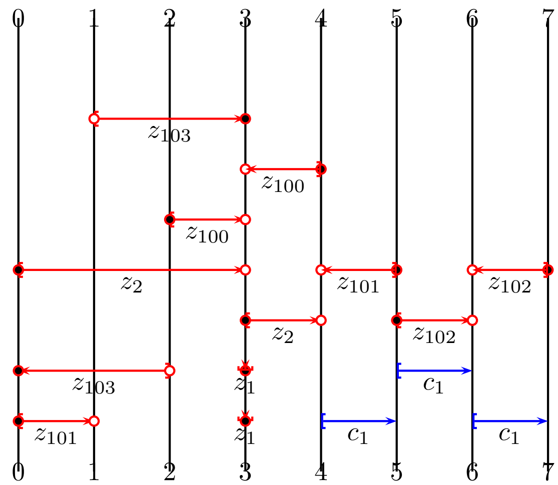
## Generalized Equation root-45.1

We begin from the GE root-45 (see pp. 227). We consider its print

```
Print 1: =0=2*<1<3*<2=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 4: Moved (old) base [0-1:z101+.] to (new) boundaries 2 - 3.
Step 5: Moved (old) base [1-2:z103+.] to (new) boundaries 3 - 5.
Step 6: Collapsed (new) base [2-5:z1+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-45.1—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-4:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [1-3:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-45.1, as derived from the application of a print to root-45.

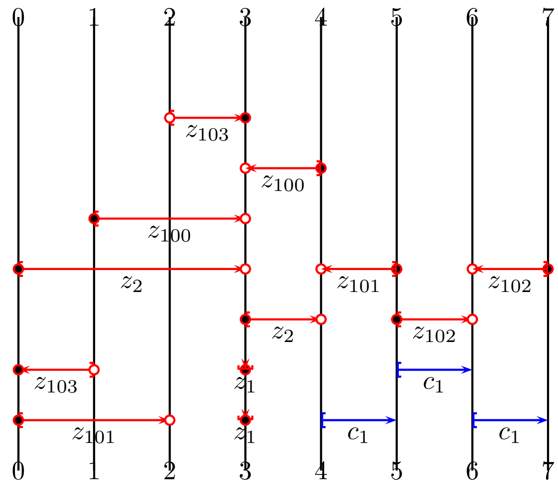
## Generalized Equation root-45.2

We begin from the GE root-45 (see pp. 227). We consider its print

```
Print 2: =0=2*<3*<1<2=4*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 4: Moved (old) base [0-1:z101+.] to (new) boundaries 2 - 4.
Step 5: Moved (old) base [1-2:z103+.] to (new) boundaries 4 - 5.
Step 6: Collapsed (new) base [2-5:z1+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

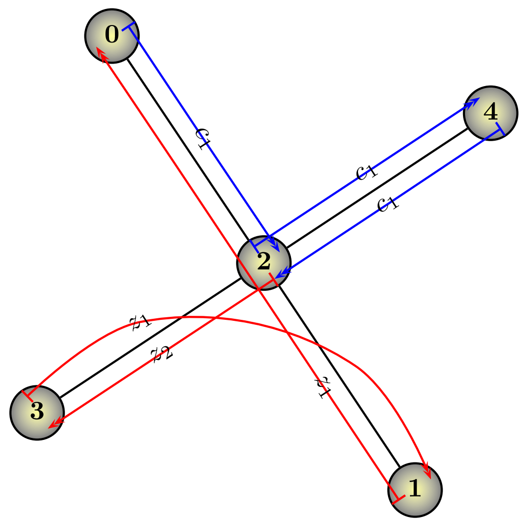
Upon applying the print, the GE we obtain—which we refer to as root-45.2—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-4:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [4-5:z101-.] has constraints with its dual that stretch the constant segment 4 - 5 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-45.2, as derived from the application of a print to root-45.

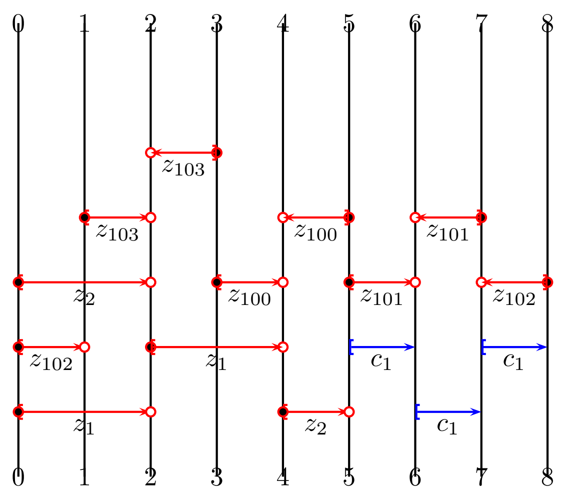
# 46 Cancellation scheme #46




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 0$ |
| $z_1$ | $3 \leftarrow 2 \leftarrow 1$ |
| $z_2$ | $2 \leftarrow 3$ |
| $c_1$ | $4 \leftarrow 2$ |
| $c_1$ | $2 \leftarrow 4$ |
| $c_1$ | $0 \leftarrow 2$ |

## Generalized Equation root-46

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-2:z1+.] ; Carrier Dual: [2-4:z1+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 2 valid prints (descendents).

It has 2 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1<3*<2=4*
Print 2: =0=2*<3*<1<2=4*
```

We proceed.

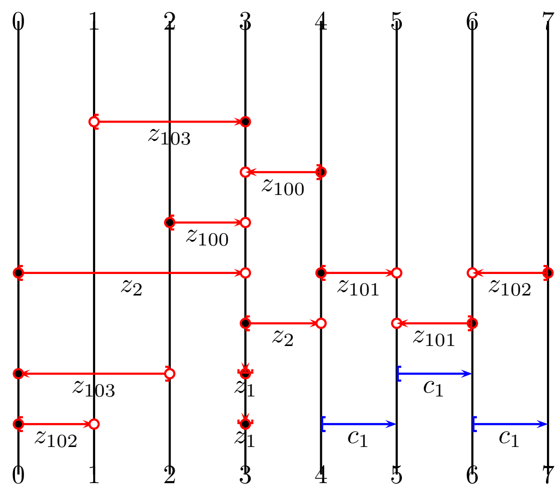
## Generalized Equation root-46.1

We begin from the GE root-46 (see pp. 231). We consider its print

```
Print 1: =0=2*<1<3*<2=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 4: Moved (old) base [0-1:z102+.] to (new) boundaries 2 - 3.
Step 5: Moved (old) base [1-2:z103+.] to (new) boundaries 3 - 5.
Step 6: Collapsed (new) base [2-5:z1+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-46.1—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-4:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [1-3:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-46.1, as derived from the application of a print to root-46.

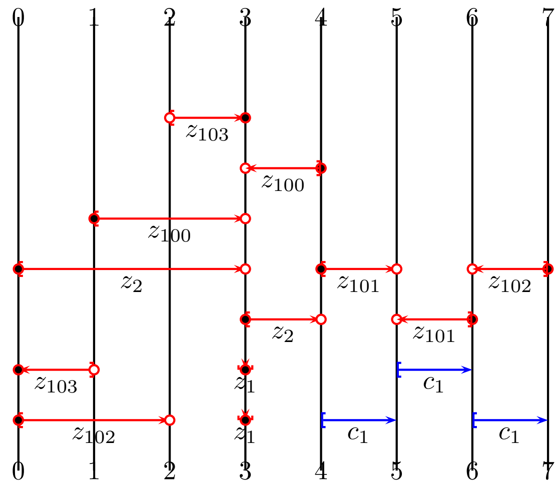
## Generalized Equation root-46.2

We begin from the GE root-46 (see pp. 231). We consider its print

```
Print 2: =0=2*<3*<1<2=4*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 4: Moved (old) base [0-1:z102+.] to (new) boundaries 2 - 4.
Step 5: Moved (old) base [1-2:z103+.] to (new) boundaries 4 - 5.
Step 6: Collapsed (new) base [2-5:z1+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

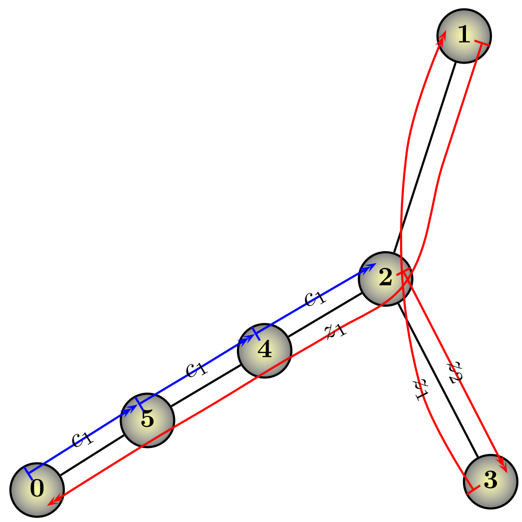
Upon applying the print, the GE we obtain—which we refer to as root-46.2—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-4:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [6-7:z102-.] has constraints with its dual that stretch the constant segment 6 - 7 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-46.2, as derived from the application of a print to root-46.

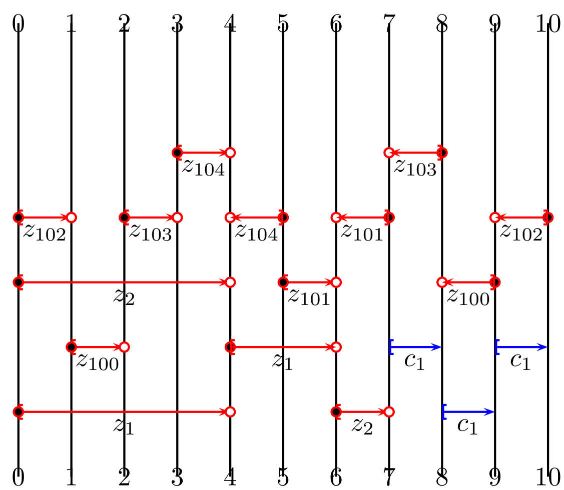
# 47 Cancellation scheme #47




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 4 \leftarrow 5 \leftarrow 0$ |
| $z_1$ | $3 \leftarrow 2 \leftarrow 1$ |
| $z_2$ | $2 \leftarrow 3$ |
| $c_1$ | $4 \leftarrow 2$ |
| $c_1$ | $5 \leftarrow 4$ |
| $c_1$ | $0 \leftarrow 5$ |

## Generalized Equation root-47

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-4:z1+.] ; Carrier Dual: [4-6:z1+.] ; Critical Boundary: 4; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 6 valid prints (descendents).

It has 6 legal carrier-to-dual prints, as follows:

```
Print 1: =0=4*<1<2<3<5*<4=6*
Print 2: =0=4*<1<2=5*<3<4=6*
Print 3: =0=4*<1<2<5*<3<4=6*
Print 4: =0=4*<1=5*<2<3<4=6*
Print 5: =0=4*<1<5*<2<3<4=6*
Print 6: =0=4*<5*<1<2<3<4=6*
```

We proceed.

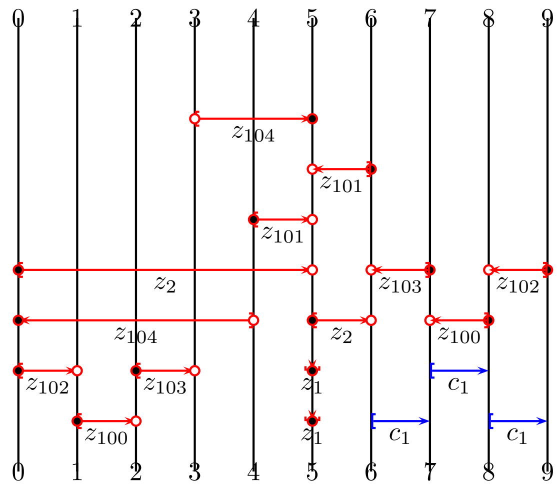
## Generalized Equation root-47.1

We begin from the GE root-47 (see pp. 235). We consider its print

```
Print 1: =0=4*<1<2<3<5*<4=6*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Added (new) boundary 7.
Step 4: Moved (old) base [0-4:z1+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 6: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 6.
Step 7: Moved (old) base [0-1:z102+.] to (new) boundaries 4 - 5.
Step 8: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 7.
Step 9: Moved (old) base [3-4:z104+.] to (new) boundaries 7 - 9.
Step 10: Collapsed (new) base [4-9:z1+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-47.1—is illustrated below:




**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-6:z2+.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [3-5:z104+.] and its dual are of opposite polarity, yet intersect. The base [0-4:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-47.1, as derived from the application of a print to root-47.

## Generalized Equation root-47.2

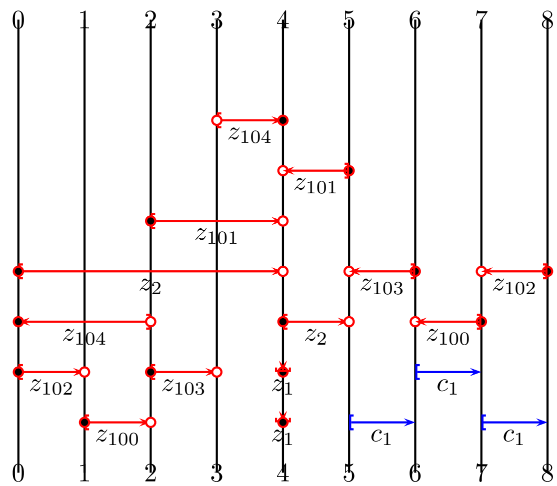
We begin from the GE root-47 (see pp. 235). We consider its print

```
Print 2: =0=4*<1<2=5*<3<4=6*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-4:z1+.] to (new) boundaries 4 - 8.
Step 4: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 8.
Step 5: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 6.
Step 6: Moved (old) base [0-1:z102+.] to (new) boundaries 4 - 5.
Step 7: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 7.
Step 8: Moved (old) base [3-4:z104+.] to (new) boundaries 7 - 8.
Step 9: Collapsed (new) base [4-8:z1+.] to the empty base (8,8).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-47.2—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-5:z2+.] ; Critical Boundary: 4; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=4*<1<2<3<4=5*
```

This completes the consideration of root-47.2, as derived from the application of a print to root-47.

## Generalized Equation root-47.3

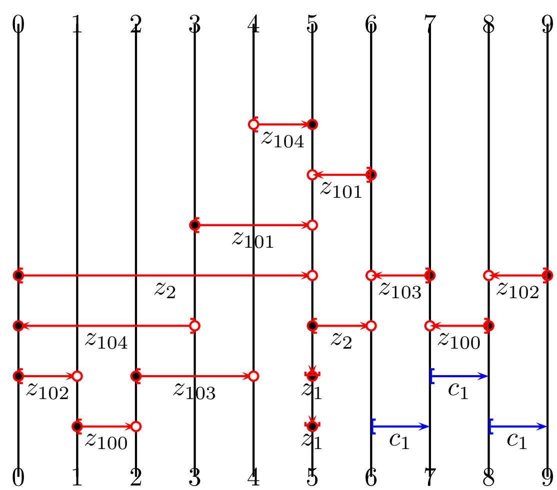
We begin from the GE root-47 (see pp. 235). We consider its print

```
Print 3: =0=4*<1<2<5*<3<4=6*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.

Step 3: Added (new) boundary 8.
Step 4: Moved (old) base [0-4:z1+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 6: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 6.
Step 7: Moved (old) base [0-1:z102+.] to (new) boundaries 4 - 5.
Step 8: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 8.
Step 9: Moved (old) base [3-4:z104+.] to (new) boundaries 8 - 9.
Step 10: Collapsed (new) base [4-9:z1+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-47.3—is illustrated below:




**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-6:z2+.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [6-7:z103-.] has constraints with its dual that stretch the constant segment 6 - 7 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-47.3, as derived from the application of a print to root-47.

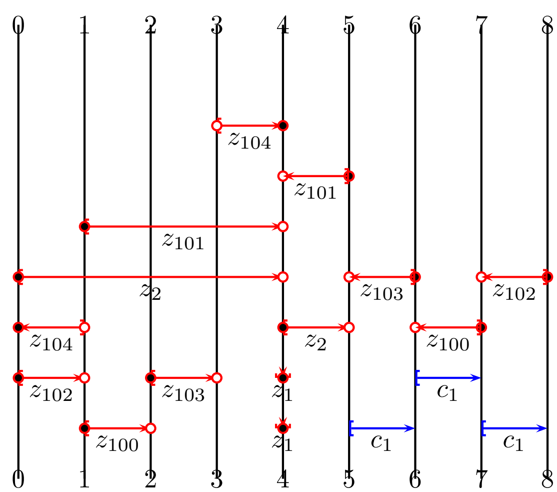
## Generalized Equation root-47.4

We begin from the GE root-47 (see pp. 235). We consider its print

```
Print 4: =0=4*<1=5*<2<3<4=6*
```

**Sequence of actions in performing the Print 4:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-4:z1+.] to (new) boundaries 4 - 8.
Step 4: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 8.
Step 5: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 6.
Step 6: Moved (old) base [0-1:z102+.] to (new) boundaries 4 - 5.
Step 7: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 7.
Step 8: Moved (old) base [3-4:z104+.] to (new) boundaries 7 - 8.
Step 9: Collapsed (new) base [4-8:z1+.] to the empty base (8,8).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-47.4—is illustrated below:



**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-5:z2+.] ; Critical Boundary: 4; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=4*<1<2<3<4=5*
```

This completes the consideration of root-47.4, as derived from the application of a print to root-47.

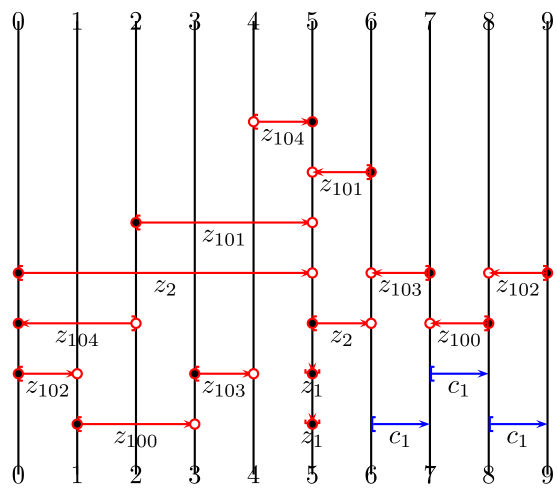
## Generalized Equation root-47.5

We begin from the GE root-47 (see pp. 235). We consider its print

```
Print 5: =0=4*<1<5*<2<3<4=6*
```

**Sequence of actions in performing the Print 5:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 7.
Step 3: Added (new) boundary 8.
Step 4: Moved (old) base [0-4:z1+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 6: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 7.
Step 7: Moved (old) base [0-1:z102+.] to (new) boundaries 4 - 5.
Step 8: Moved (old) base [2-3:z103+.] to (new) boundaries 7 - 8.
Step 9: Moved (old) base [3-4:z104+.] to (new) boundaries 8 - 9.
Step 10: Collapsed (new) base [4-9:z1+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-47.5—is illustrated below:




**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-6:z2+.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [7-8:z100-.] has constraints with its dual that stretch the constant segment 7 - 8 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-47.5, as derived from the application of a print to root-47.

## Generalized Equation root-47.6

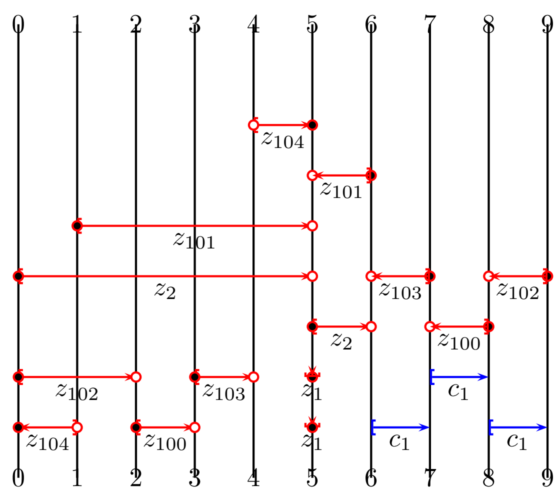
We begin from the GE root-47 (see pp. 235). We consider its print

```
Print 6: =0=4*<5*<1<2<3<4=6*
```

**Sequence of actions in performing the Print 6:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 7.
Step 3: Added (new) boundary 8.
Step 4: Moved (old) base [0-4:z1+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 6: Moved (old) base [1-2:z100+.] to (new) boundaries 6 - 7.
Step 7: Moved (old) base [0-1:z102+.] to (new) boundaries 4 - 6.
Step 8: Moved (old) base [2-3:z103+.] to (new) boundaries 7 - 8.
Step 9: Moved (old) base [3-4:z104+.] to (new) boundaries 8 - 9.
Step 10: Collapsed (new) base [4-9:z1+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This

will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-47.6—is illustrated below:




**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-6:z2+.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [8-9:z102-.] has constraints with its dual that stretch the constant segment 8 - 9 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-47.6, as derived from the application of a print to root-47.

## Generalized Equation root-47.2.1

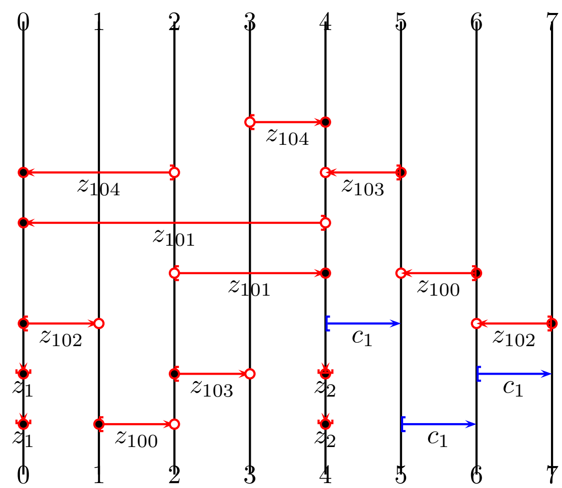
We begin from the GE root-47.2 (see pp. 237). We consider its print

```
Print 1: =0=4*<1<2<3<4=5*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 5.

Step 2: Added (new) boundary 6.
Step 3: Added (new) boundary 7.
Step 4: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 8.
Step 5: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 6.
Step 6: Moved (old) base [2-4:z101+.] to (new) boundaries 6 - 8.
Step 7: Moved (old) base [0-1:z102+.] to (new) boundaries 4 - 5.
Step 8: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 7.
Step 9: Moved (old) base [3-4:z104+.] to (new) boundaries 7 - 8.
Step 10: Moved (old) base [0-2:z104-.] to (new) boundaries 4 - 6.
Step 11: Collapsed (new) base [4-8:z2+.] to the empty base (8,8).
Step 12: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 15: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-47.2.1—is illustrated below:




**GE Information**: Carrier: [0-4:z101-.] ; Carrier Dual: [2-4:z101+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [2-4:z101+.] and its dual are of opposite polarity, yet intersect. The base [0-4:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-47.2.1, as derived from the application

of a print to root-47.2.

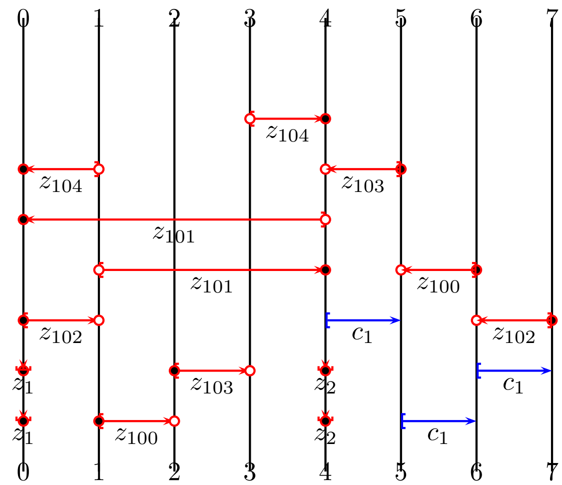
## Generalized Equation root-47.4.1

We begin from the GE root-47.4 (see pp. 240). We consider its print

```
Print 1: =0=4*<1<2<3<4=5*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Added (new) boundary 7.
Step 4: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 8.
Step 5: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 6.
Step 6: Moved (old) base [1-4:z101+.] to (new) boundaries 5 - 8.
Step 7: Moved (old) base [0-1:z102+.] to (new) boundaries 4 - 5.
Step 8: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 7.
Step 9: Moved (old) base [3-4:z104+.] to (new) boundaries 7 - 8.
Step 10: Moved (old) base [0-1:z104-.] to (new) boundaries 4 - 5.
Step 11: Collapsed (new) base [4-8:z2+.] to the empty base (8,8).
Step 12: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 15: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

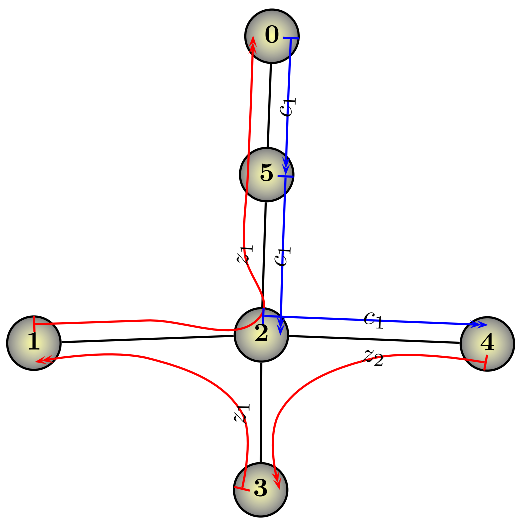
Upon applying the print, the GE we obtain—which we refer to as root-47.4.1—is illustrated below:




**GE Information**: Carrier: [0-4:z101-.] ; Carrier Dual: [1-4:z101+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [1-4:z101+.] and its dual are of opposite polarity, yet intersect. The base [0-4:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-47.4.1, as derived from the application of a print to root-47.4.

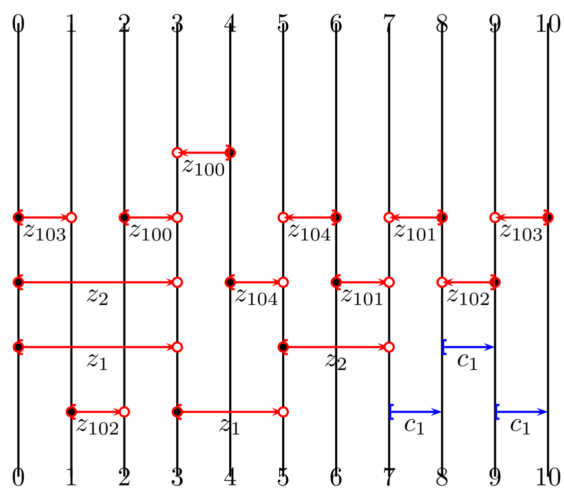
# 48 Cancellation scheme #48




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 5 \leftarrow 0$ |
| $z_1$ | $3 \leftarrow 2 \leftarrow 1$ |
| $z_2$ | $4 \leftarrow 2 \leftarrow 3$ |
| $c_1$ | $2 \leftarrow 4$ |
| $c_1$ | $5 \leftarrow 2$ |
| $c_1$ | $0 \leftarrow 5$ |

## Generalized Equation root-48

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-3:z1+.] ; Carrier Dual: [3-5:z1+.] ; Critical Boundary: 3; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 4 valid prints (descendents).

It has 4 legal carrier-to-dual prints, as follows:

```
Print 1: =0=3*<1<2<4*<3=5*
Print 2: =0=3*<1=4*<2<3=5*
Print 3: =0=3*<1<4*<2<3=5*
Print 4: =0=3*<4*<1<2<3=5*
```

We proceed.

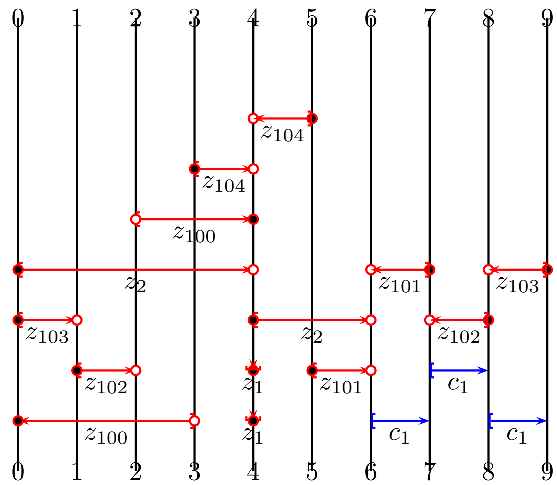
## Generalized Equation root-48.1

We begin from the GE root-48 (see pp. 247). We consider its print

```
Print 1: =0=3*<1<2<4*<3=5*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 5.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 5: Moved (old) base [2-3:z100+.] to (new) boundaries 5 - 7.
Step 6: Moved (old) base [1-2:z102+.] to (new) boundaries 4 - 5.
Step 7: Moved (old) base [0-1:z103+.] to (new) boundaries 3 - 4.
Step 8: Collapsed (new) base [3-7:z1+.] to the empty base (7,7).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-48.1—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-6:z2+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [2-4:z100+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z100-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-48.1, as derived from the application of a print to root-48.

## Generalized Equation root-48.2

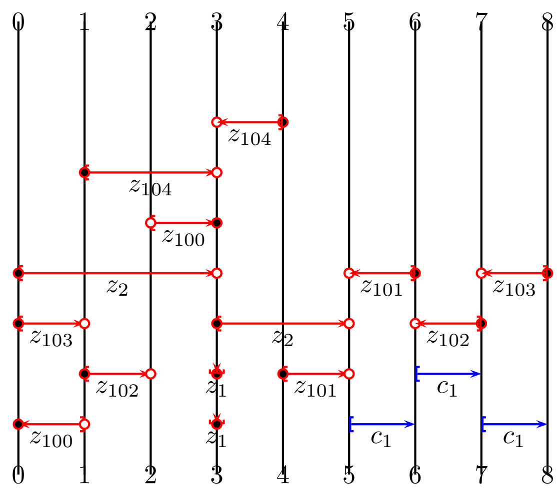
We begin from the GE root-48 (see pp. 247). We consider its print

```
Print 2: =0=3*<1=4*<2<3=5*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 5.
Step 2: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 6.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 6.
Step 4: Moved (old) base [2-3:z100+.] to (new) boundaries 5 - 6.
Step 5: Moved (old) base [1-2:z102+.] to (new) boundaries 4 - 5.
Step 6: Moved (old) base [0-1:z103+.] to (new) boundaries 3 - 4.
Step 7: Collapsed (new) base [3-6:z1+.] to the empty base (6,6).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-48.2—is illustrated below:



**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-5:z2+.] ; Critical Boundary: 3; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 4 valid prints (descendents).

It has 4 legal carrier-to-dual prints, as follows:

```
Print 1: =0=3*<1<2=4*<3=5*
Print 2: =0=3*<1<2<4*<3=5*
Print 3: =0=3*<1<4*<2<3=5*
Print 4: =0=3*<4*<1<2<3=5*
```

This completes the consideration of root-48.2, as derived from the application of a print to root-48.

## Generalized Equation root-48.3

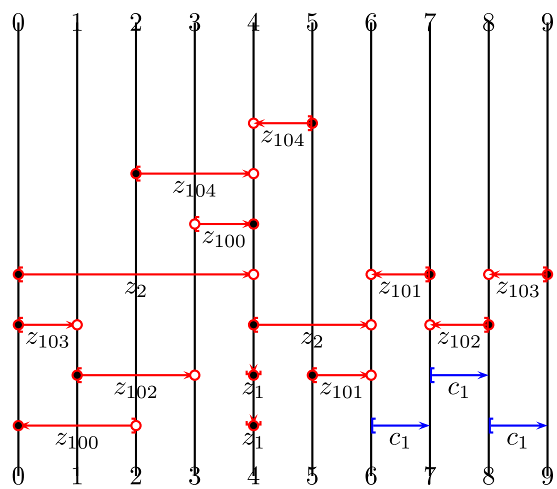
We begin from the GE root-48 (see pp. 247). We consider its print

```
Print 3: =0=3*<1<4*<2<3=5*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 7.

Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 5: Moved (old) base [2-3:z100+.] to (new) boundaries 6 - 7.
Step 6: Moved (old) base [1-2:z102+.] to (new) boundaries 4 - 6.
Step 7: Moved (old) base [0-1:z103+.] to (new) boundaries 3 - 4.
Step 8: Collapsed (new) base [3-7:z1+.] to the empty base (7,7).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-48.3—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-6:z2+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [7-8:z102-.] has constraints with its dual that stretch the constant segment 7 - 8 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-48.3, as derived from the application of a print to root-48.

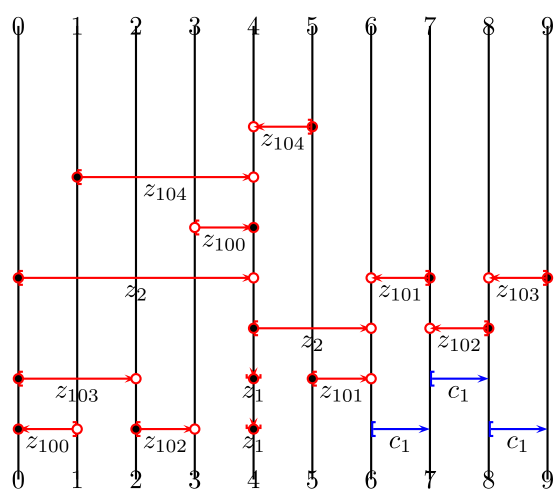
## Generalized Equation root-48.4

We begin from the GE root-48 (see pp. 247). We consider its print

```
Print 4: =0=3*<4*<1<2<3=5*
```

**Sequence of actions in performing the Print 4:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 5: Moved (old) base [2-3:z100+.] to (new) boundaries 6 - 7.
Step 6: Moved (old) base [1-2:z102+.] to (new) boundaries 5 - 6.
Step 7: Moved (old) base [0-1:z103+.] to (new) boundaries 3 - 5.
Step 8: Collapsed (new) base [3-7:z1+.] to the empty base (7,7).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-48.4—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-6:z2+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [8-9:z103-.] has constraints with its dual that stretch the constant segment 8 - 9 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-48.4, as derived from the application of a print to root-48.

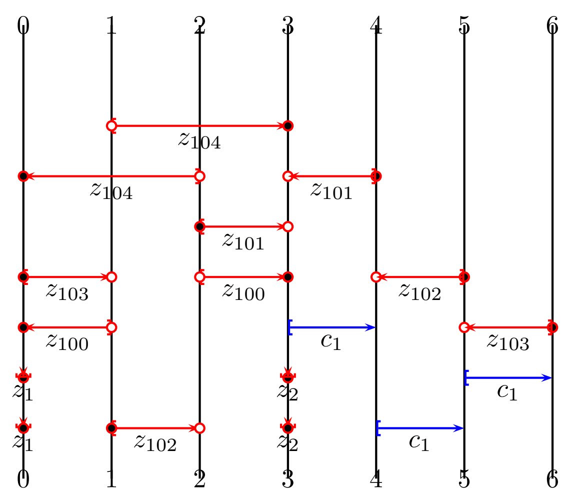
## Generalized Equation root-48.2.1

We begin from the GE root-48.2 (see pp. 249). We consider its print

```
Print 1: =0=3*<1<2=4*<3=5*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 6.
Step 3: Moved (old) base [2-3:z100+.] to (new) boundaries 5 - 6.
Step 4: Moved (old) base [0-1:z100-.] to (new) boundaries 3 - 4.
Step 5: Moved (old) base [1-2:z102+.] to (new) boundaries 4 - 5.
Step 6: Moved (old) base [0-1:z103+.] to (new) boundaries 3 - 4.
Step 7: Moved (old) base [1-3:z104+.] to (new) boundaries 4 - 6.
Step 8: Collapsed (new) base [3-6:z2+.] to the empty base (6,6).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-48.2.1—is illustrated below:




**GE Information**: Carrier: [0-2:z104-.] ; Carrier Dual: [1-3:z104+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-3:z104+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-48.2.1, as derived from the application of a print to root-48.2.

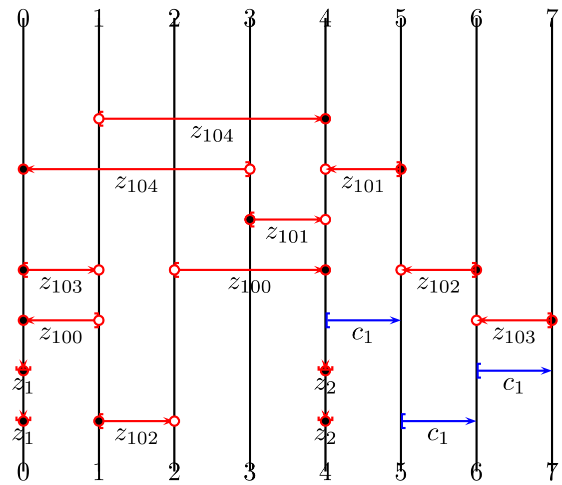
## Generalized Equation root-48.2.2

We begin from the GE root-48.2 (see pp. 249). We consider its print

```
Print 2: =0=3*<1<2<4*<3=5*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 5.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [2-3:z100+.] to (new) boundaries 5 - 7.
Step 5: Moved (old) base [0-1:z100-.] to (new) boundaries 3 - 4.
Step 6: Moved (old) base [1-2:z102+.] to (new) boundaries 4 - 5.
Step 7: Moved (old) base [0-1:z103+.] to (new) boundaries 3 - 4.
Step 8: Moved (old) base [1-3:z104+.] to (new) boundaries 4 - 7.
Step 9: Collapsed (new) base [3-7:z2+.] to the empty base (7,7).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-48.2.2—is illustrated below:




**GE Information**: Carrier: [0-3:z104-.] ; Carrier Dual: [1-4:z104+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-4:z104+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-48.2.2, as derived from the application of a print to root-48.2.

## Generalized Equation root-48.2.3

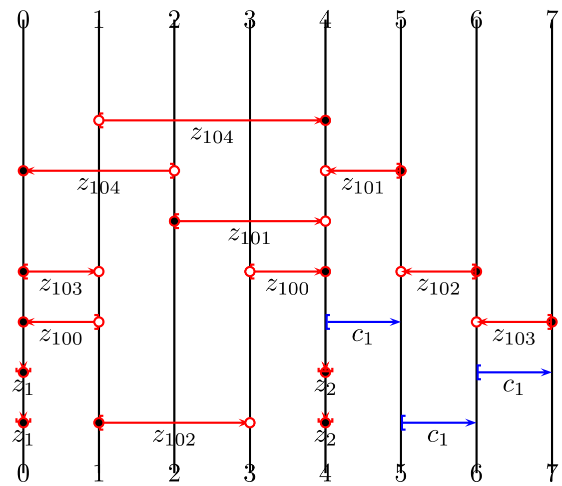
We begin from the GE root-48.2 (see pp. 249). We consider its print

```
Print 3: =0=3*<1<4*<2<3=5*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [2-3:z100+.] to (new) boundaries 6 - 7.
Step 5: Moved (old) base [0-1:z100-.] to (new) boundaries 3 - 4.
Step 6: Moved (old) base [1-2:z102+.] to (new) boundaries 4 - 6.
Step 7: Moved (old) base [0-1:z103+.] to (new) boundaries 3 - 4.
Step 8: Moved (old) base [1-3:z104+.] to (new) boundaries 4 - 7.
Step 9: Collapsed (new) base [3-7:z2+.] to the empty base (7,7).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-48.2.3—is illustrated below:




**GE Information**: Carrier: [0-2:z104-.] ; Carrier Dual: [1-4:z104+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-4:z104+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-48.2.3, as derived from the application of a print to root-48.2.

## Generalized Equation root-48.2.4

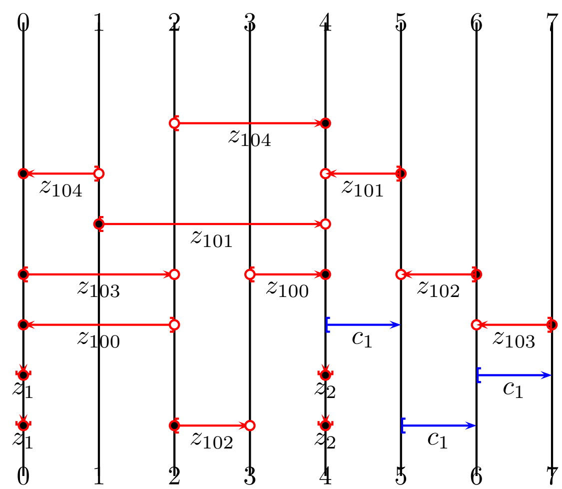
We begin from the GE root-48.2 (see pp. 249). We consider its print

```
Print 4: =0=3*<4*<1<2<3=5*
```

**Sequence of actions in performing the Print 4:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [2-3:z100+.] to (new) boundaries 6 - 7.

Step 5: Moved (old) base [0-1:z100-.] to (new) boundaries 3 - 5.
Step 6: Moved (old) base [1-2:z102+.] to (new) boundaries 5 - 6.
Step 7: Moved (old) base [0-1:z103+.] to (new) boundaries 3 - 5.
Step 8: Moved (old) base [1-3:z104+.] to (new) boundaries 5 - 7.
Step 9: Collapsed (new) base [3-7:z2+.] to the empty base (7,7).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

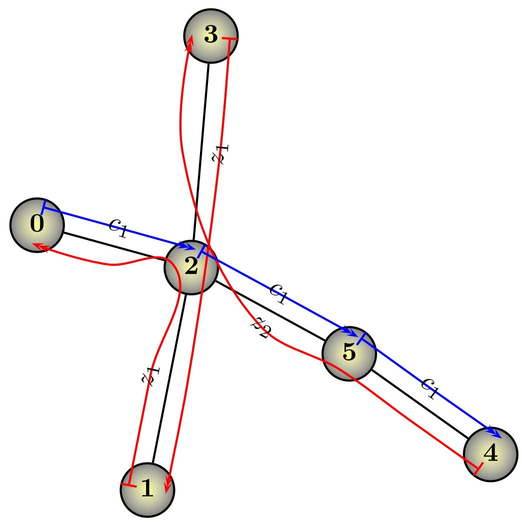
Upon applying the print, the GE we obtain—which we refer to as root-48.2.4—is illustrated below:




**GE Information**: Carrier: [0-2:z100-.] ; Carrier Dual: [3-4:z100+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [4-5:z101-.] has constraints with its dual that stretch the constant segment 4 - 5 to length different from 1. The base [6-7:z103-.] has constraints with its dual that stretch the constant segment 6 - 7 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-48.2.4, as derived from the application of a print to root-48.2.

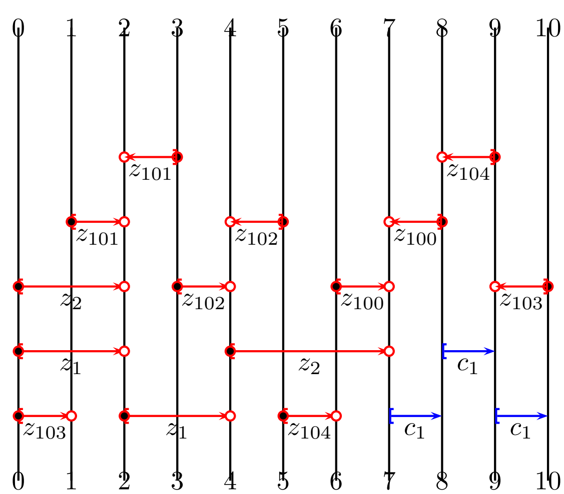
# 49 Cancellation scheme #49




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 0$ |
| $z_1$ | $3 \leftarrow 2 \leftarrow 1$ |
| $z_2$ | $4 \leftarrow 5 \leftarrow 2 \leftarrow 3$ |
| $c_1$ | $5 \leftarrow 4$ |
| $c_1$ | $2 \leftarrow 5$ |
| $c_1$ | $0 \leftarrow 2$ |

## Generalized Equation root-49

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-2:z1+.] ; Carrier Dual: [2-4:z1+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 2 valid prints (descendents).

It has 2 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1<3*<2=4*
Print 2: =0=2*<3*<1<2=4*
```

We proceed.

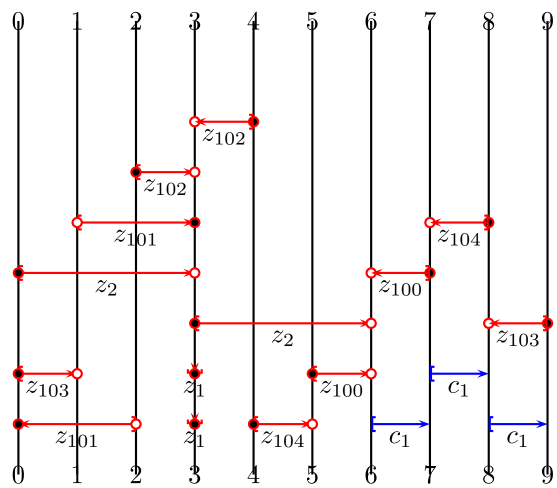
## Generalized Equation root-49.1

We begin from the GE root-49 (see pp. 258). We consider its print

```
Print 1: =0=2*<1<3*<2=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 4: Moved (old) base [1-2:z101+.] to (new) boundaries 3 - 5.
Step 5: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 3.
Step 6: Collapsed (new) base [2-5:z1+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-49.1—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-6:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [1-3:z101+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-49.1, as derived from the application of a print to root-49.

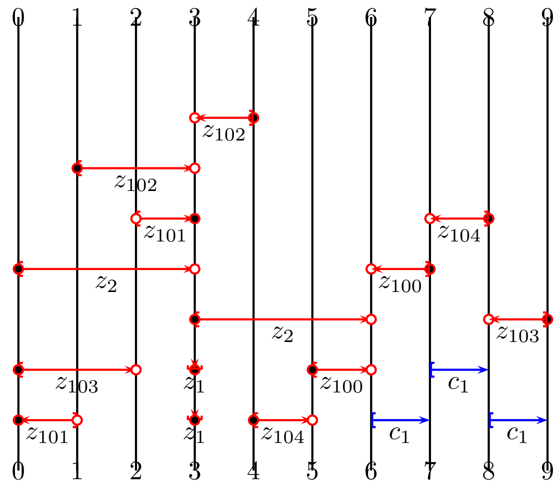
## Generalized Equation root-49.2

We begin from the GE root-49 (see pp. 258). We consider its print

```
Print 2: =0=2*<3*<1<2=4*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 4: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 5.
Step 5: Moved (old) base [0-1:z103+.] to (new) boundaries 2 - 4.
Step 6: Collapsed (new) base [2-5:z1+.] to the empty base (5,5).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

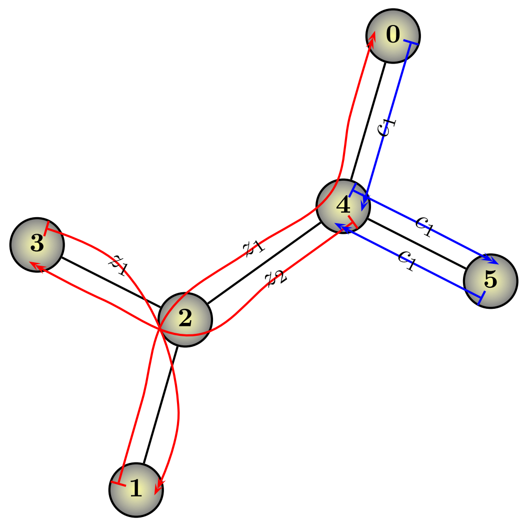
Upon applying the print, the GE we obtain—which we refer to as root-49.2—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-6:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [8-9:z103-.] has constraints with its dual that stretch the constant segment 8 - 9 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-49.2, as derived from the application of a print to root-49.

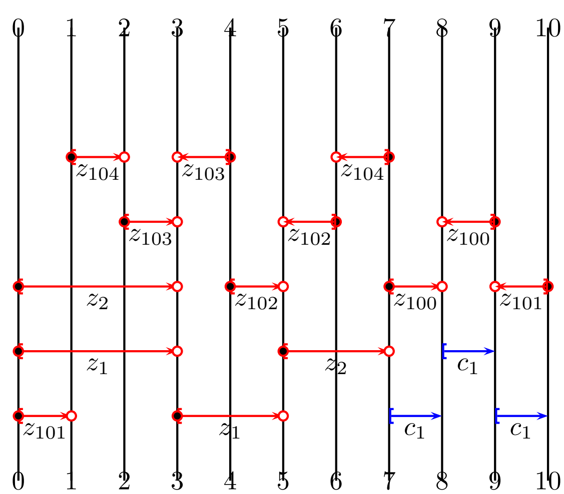
# 50 Cancellation scheme #50




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 4 \leftarrow 0$ |
| $z_1$ | $3 \leftarrow 2 \leftarrow 1$ |
| $z_2$ | $4 \leftarrow 2 \leftarrow 3$ |
| $c_1$ | $5 \leftarrow 4$ |
| $c_1$ | $4 \leftarrow 5$ |
| $c_1$ | $0 \leftarrow 4$ |

## Generalized Equation root-50

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-3:z1+.] ; Carrier Dual: [3-5:z1+.] ; Critical Boundary: 3; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 4 valid prints (descendents).

It has 4 legal carrier-to-dual prints, as follows:

```
Print 1: =0=3*<1<2<4*<3=5*
Print 2: =0=3*<1=4*<2<3=5*
Print 3: =0=3*<1<4*<2<3=5*
Print 4: =0=3*<4*<1<2<3=5*
```

We proceed.

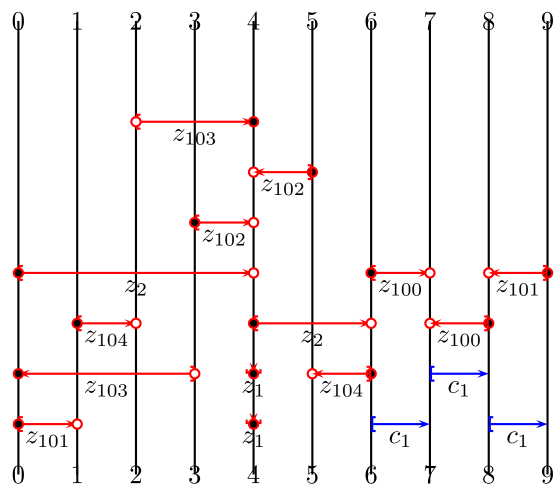
## Generalized Equation root-50.1

We begin from the GE root-50 (see pp. 262). We consider its print

```
Print 1: =0=3*<1<2<4*<3=5*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 5.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 5: Moved (old) base [0-1:z101+.] to (new) boundaries 3 - 4.
Step 6: Moved (old) base [2-3:z103+.] to (new) boundaries 5 - 7.
Step 7: Moved (old) base [1-2:z104+.] to (new) boundaries 4 - 5.
Step 8: Collapsed (new) base [3-7:z1+.] to the empty base (7,7).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-50.1—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-6:z2+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [2-4:z103+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-50.1, as derived from the application of a print to root-50.

## Generalized Equation root-50.2

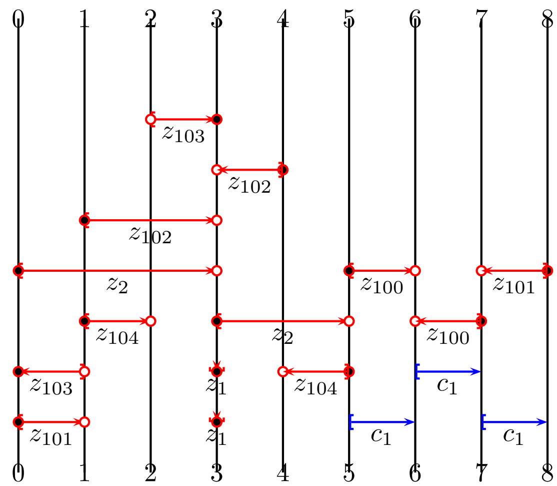
We begin from the GE root-50 (see pp. 262). We consider its print

```
Print 2: =0=3*<1=4*<2<3=5*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 5.
Step 2: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 6.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 6.
Step 4: Moved (old) base [0-1:z101+.] to (new) boundaries 3 - 4.
Step 5: Moved (old) base [2-3:z103+.] to (new) boundaries 5 - 6.
Step 6: Moved (old) base [1-2:z104+.] to (new) boundaries 4 - 5.
Step 7: Collapsed (new) base [3-6:z1+.] to the empty base (6,6).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-50.2—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-5:z2+.] ; Critical Boundary: 3; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 3 valid prints (descendents).

It has 3 legal carrier-to-dual prints, as follows:

```
Print 1: =0=3*<1<2<4*<3=5*
Print 2: =0=3*<1<4*<2<3=5*
Print 3: =0=3*<4*<1<2<3=5*
```

This completes the consideration of root-50.2, as derived from the application of a print to root-50.

## Generalized Equation root-50.3

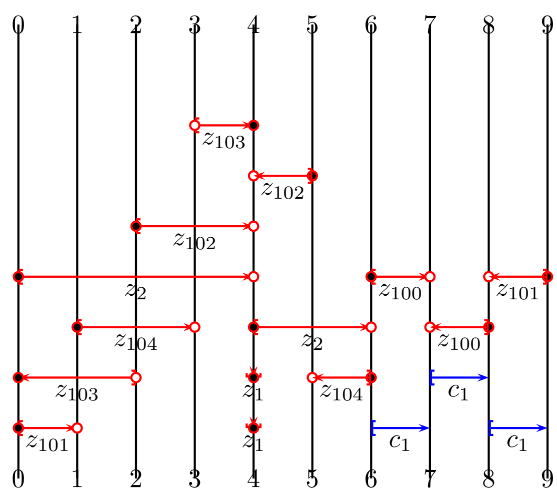
We begin from the GE root-50 (see pp. 262). We consider its print

```
Print 3: =0=3*<1<4*<2<3=5*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.

Step 5: Moved (old) base [0-1:z101+.] to (new) boundaries 3 - 4.
Step 6: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 7.
Step 7: Moved (old) base [1-2:z104+.] to (new) boundaries 4 - 6.
Step 8: Collapsed (new) base [3-7:z1+.] to the empty base (7,7).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-50.3—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-6:z2+.] ; Critical Boundary: 4; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 5 valid prints (descendents).

It has 5 legal carrier-to-dual prints, as follows:

```
Print 1: =0=4*<1<2<3<5*<4=6*
Print 2: =0=4*<1<2<5*<3<4=6*
Print 3: =0=4*<1=5*<2<3<4=6*
Print 4: =0=4*<1<5*<2<3<4=6*
Print 5: =0=4*<5*<1<2<3<4=6*
```

This completes the consideration of root-50.3, as derived from the application of a print to root-50.

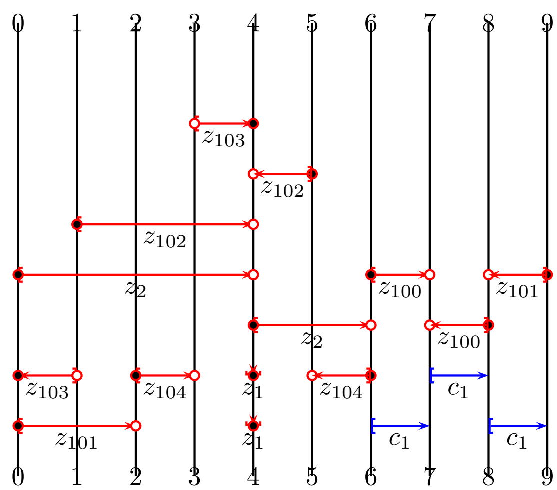
## Generalized Equation root-50.4

We begin from the GE root-50 (see pp. 262). We consider its print

```
Print 4: =0=3*<4*<1<2<3=5*
```

**Sequence of actions in performing the Print 4:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 5: Moved (old) base [0-1:z101+.] to (new) boundaries 3 - 5.
Step 6: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 7.
Step 7: Moved (old) base [1-2:z104+.] to (new) boundaries 5 - 6.
Step 8: Collapsed (new) base [3-7:z1+.] to the empty base (7,7).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-50.4—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-6:z2+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [8-9:z101-.] has constraints with its dual that stretch the constant segment 8 - 9 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-50.4, as derived from the application of a print to root-50.

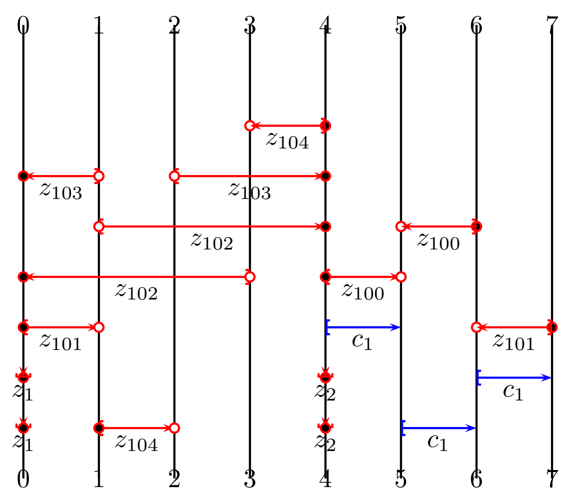
## Generalized Equation root-50.2.1

We begin from the GE root-50.2 (see pp. 264). We consider its print

```
Print 1: =0=3*<1<2<4*<3=5*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 5.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [0-1:z101+.] to (new) boundaries 3 - 4.
Step 5: Moved (old) base [1-3:z102+.] to (new) boundaries 4 - 7.
Step 6: Moved (old) base [2-3:z103+.] to (new) boundaries 5 - 7.
Step 7: Moved (old) base [0-1:z103-.] to (new) boundaries 3 - 4.
Step 8: Moved (old) base [1-2:z104+.] to (new) boundaries 4 - 5.
Step 9: Collapsed (new) base [3-7:z2+.] to the empty base (7,7).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-50.2.1—is illustrated below:



**GE Information**: Carrier: [0-3:z102-.] ; Carrier Dual: [1-4:z102+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-4:z102+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-50.2.1, as derived from the application of a print to root-50.2.

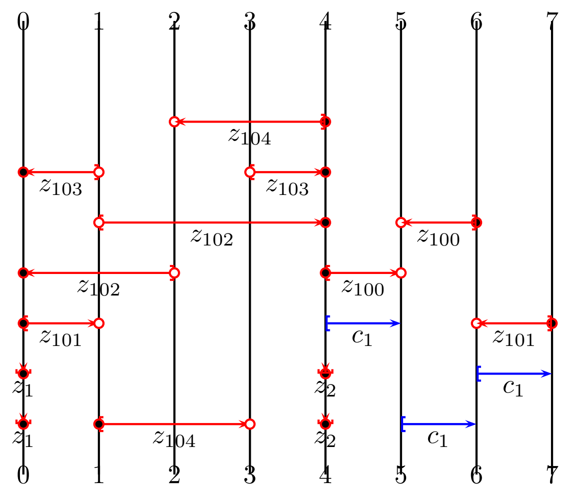
## Generalized Equation root-50.2.2

We begin from the GE root-50.2 (see pp. 264). We consider its print

```
Print 2: =0=3*<1<4*<2<3=5*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [0-1:z101+.] to (new) boundaries 3 - 4.
Step 5: Moved (old) base [1-3:z102+.] to (new) boundaries 4 - 7.
Step 6: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 7.
Step 7: Moved (old) base [0-1:z103-.] to (new) boundaries 3 - 4.
Step 8: Moved (old) base [1-2:z104+.] to (new) boundaries 4 - 6.
Step 9: Collapsed (new) base [3-7:z2+.] to the empty base (7,7).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-50.2.2—is illustrated below:




**GE Information**: Carrier: [0-2:z102-.] ; Carrier Dual: [1-4:z102+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-4:z102+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z102-.] and its dual are of opposite polarity, yet intersect. The base [1-3:z104+.] and its dual are of opposite polarity, yet intersect. The base [2-4:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-50.2.2, as derived from the application of a print to root-50.2.

## Generalized Equation root-50.2.3

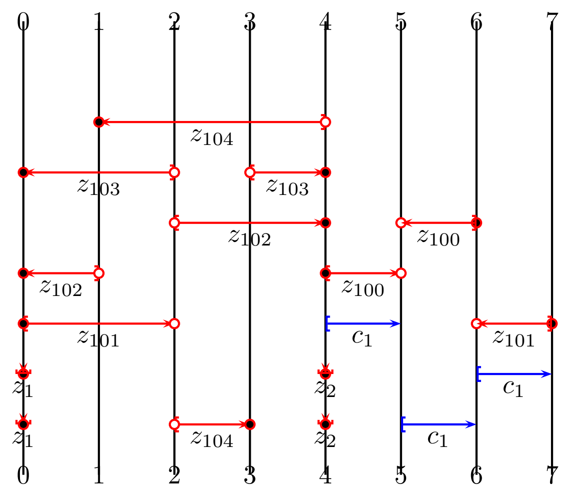
We begin from the GE root-50.2 (see pp. 264). We consider its print

```
Print 3: =0=3*<4*<1<2<3=5*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [0-1:z101+.] to (new) boundaries 3 - 5.
Step 5: Moved (old) base [1-3:z102+.] to (new) boundaries 5 - 7.
Step 6: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 7.
Step 7: Moved (old) base [0-1:z103-.] to (new) boundaries 3 - 5.
Step 8: Moved (old) base [1-2:z104+.] to (new) boundaries 5 - 6.
Step 9: Collapsed (new) base [3-7:z2+.] to the empty base (7,7).

Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-50.2.3—is illustrated below:




**GE Information**: Carrier: [0-2:z101+.] ; Carrier Dual: [6-7:z101-.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [2-3:z104+.] and its dual are of opposite polarity, yet intersect. The base [1-4:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-50.2.3, as derived from the application of a print to root-50.2.

## Generalized Equation root-50.3.1

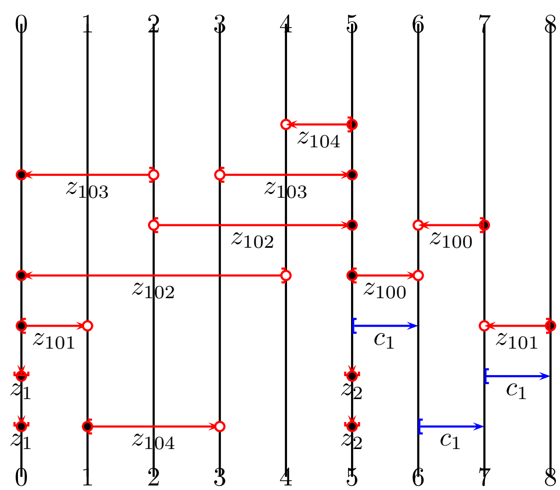
We begin from the GE root-50.3 (see pp. 265). We consider its print

```
Print 1: =0=4*<1<2<3<5*<4=6*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.

Step 3: Added (new) boundary 7.
Step 4: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [0-1:z101+.] to (new) boundaries 4 - 5.
Step 6: Moved (old) base [2-4:z102+.] to (new) boundaries 6 - 9.
Step 7: Moved (old) base [3-4:z103+.] to (new) boundaries 7 - 9.
Step 8: Moved (old) base [0-2:z103-.] to (new) boundaries 4 - 6.
Step 9: Moved (old) base [1-3:z104+.] to (new) boundaries 5 - 7.
Step 10: Collapsed (new) base [4-9:z2+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-50.3.1—is illustrated below:




**GE Information**: Carrier: [0-4:z102-.] ; Carrier Dual: [2-5:z102+.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [2-5:z102+.] and its dual are of opposite polarity, yet intersect. The base [0-4:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-50.3.1, as derived from the application of a print to root-50.3.

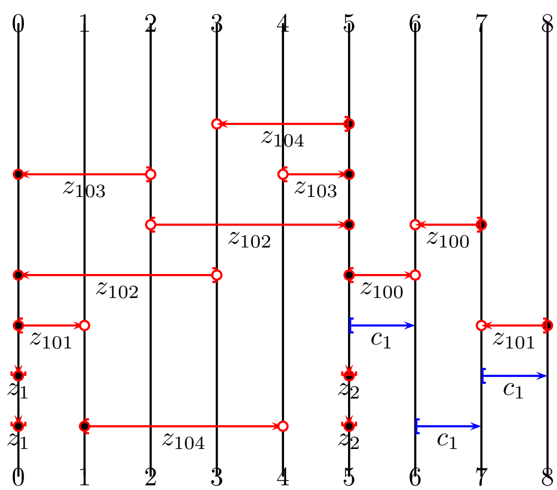
## Generalized Equation root-50.3.2

We begin from the GE root-50.3 (see pp. 265). We consider its print

```
Print 2: =0=4*<1<2<5*<3<4=6*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Added (new) boundary 8.
Step 4: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [0-1:z101+.] to (new) boundaries 4 - 5.
Step 6: Moved (old) base [2-4:z102+.] to (new) boundaries 6 - 9.
Step 7: Moved (old) base [3-4:z103+.] to (new) boundaries 8 - 9.
Step 8: Moved (old) base [0-2:z103-.] to (new) boundaries 4 - 6.
Step 9: Moved (old) base [1-3:z104+.] to (new) boundaries 5 - 8.
Step 10: Collapsed (new) base [4-9:z2+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-50.3.2—is illustrated below:



**GE Information**: Carrier: [0-3:z102-.] ; Carrier Dual: [2-5:z102+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [2-5:z102+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z102-.] and its dual are of opposite polarity, yet intersect. The base [1-4:z104+.] and its dual are of opposite polarity, yet intersect. The base [3-5:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-50.3.2, as derived from the application of a print to root-50.3.

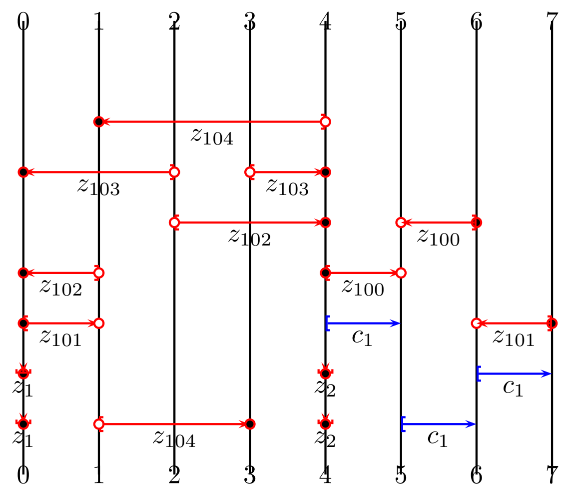
## Generalized Equation root-50.3.3

We begin from the GE root-50.3 (see pp. 265). We consider its print

```
Print 3: =0=4*<1=5*<2<3<4=6*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 8.
Step 4: Moved (old) base [0-1:z101+.] to (new) boundaries 4 - 5.
Step 5: Moved (old) base [2-4:z102+.] to (new) boundaries 6 - 8.
Step 6: Moved (old) base [3-4:z103+.] to (new) boundaries 7 - 8.
Step 7: Moved (old) base [0-2:z103-.] to (new) boundaries 4 - 6.
Step 8: Moved (old) base [1-3:z104+.] to (new) boundaries 5 - 7.
Step 9: Collapsed (new) base [4-8:z2+.] to the empty base (8,8).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-50.3.3—is illustrated below:




**GE Information**: Carrier: [0-2:z103-.] ; Carrier Dual: [3-4:z103+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-3:z104+.] and its dual are of opposite polarity, yet intersect. The base [1-4:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-50.3.3, as derived from the application of a print to root-50.3.

## Generalized Equation root-50.3.4

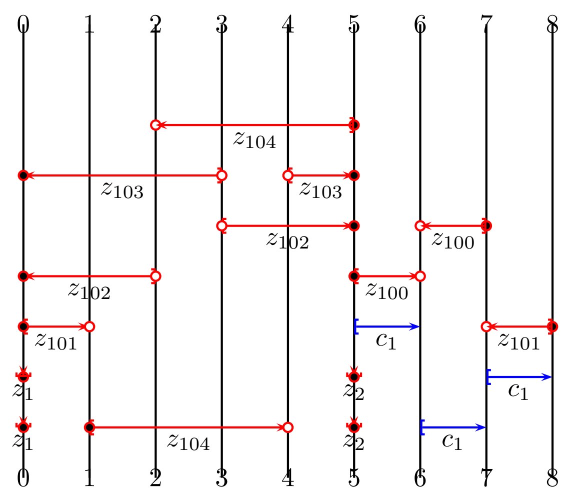
We begin from the GE root-50.3 (see pp. 265). We consider its print

```
Print 4: =0=4*<1<5*<2<3<4=6*
```

**Sequence of actions in performing the Print 4:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 7.
Step 3: Added (new) boundary 8.
Step 4: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [0-1:z101+.] to (new) boundaries 4 - 5.
Step 6: Moved (old) base [2-4:z102+.] to (new) boundaries 7 - 9.
Step 7: Moved (old) base [3-4:z103+.] to (new) boundaries 8 - 9.
Step 8: Moved (old) base [0-2:z103-.] to (new) boundaries 4 - 7.
Step 9: Moved (old) base [1-3:z104+.] to (new) boundaries 5 - 8.
Step 10: Collapsed (new) base [4-9:z2+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This

will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-50.3.4—is illustrated below:



**GE Information**: Carrier: [0-3:z103-.] ; Carrier Dual: [4-5:z103+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-4:z104+.] and its dual are of opposite polarity, yet intersect. The base [2-5:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-50.3.4, as derived from the application of a print to root-50.3.

## Generalized Equation root-50.3.5

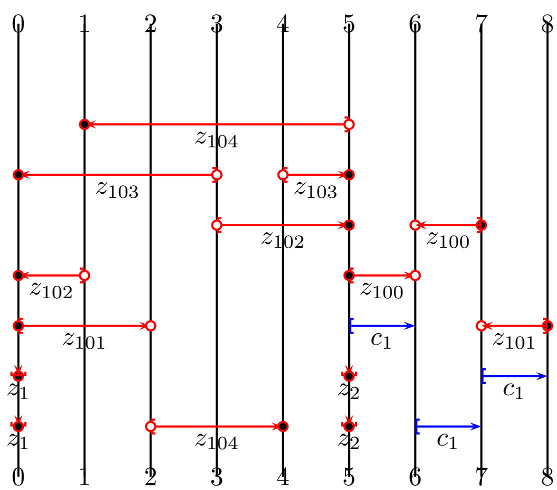
We begin from the GE root-50.3 (see pp. 265). We consider its print

```
Print 5: =0=4*<5*<1<2<3<4=6*
```

**Sequence of actions in performing the Print 5:**
Step 1: Added (new) boundary 6.

Step 2: Added (new) boundary 7.
Step 3: Added (new) boundary 8.
Step 4: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [0-1:z101+.] to (new) boundaries 4 - 6.
Step 6: Moved (old) base [2-4:z102+.] to (new) boundaries 7 - 9.
Step 7: Moved (old) base [3-4:z103+.] to (new) boundaries 8 - 9.
Step 8: Moved (old) base [0-2:z103-.] to (new) boundaries 4 - 7.
Step 9: Moved (old) base [1-3:z104+.] to (new) boundaries 6 - 8.
Step 10: Collapsed (new) base [4-9:z2+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

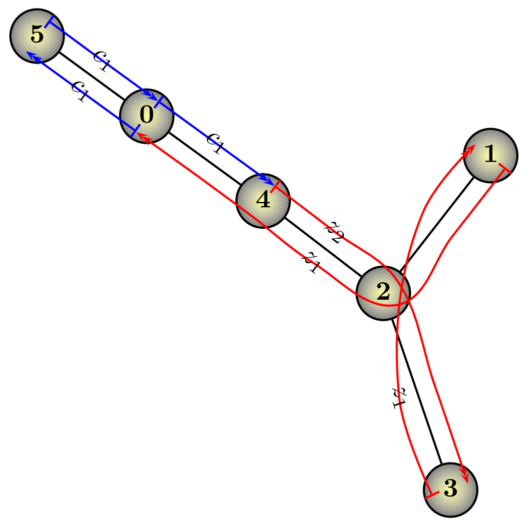
Upon applying the print, the GE we obtain—which we refer to as root-50.3.5—is illustrated below:




**GE Information**: Carrier: [0-3:z103-.] ; Carrier Dual: [4-5:z103+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [2-4:z104+.] and its dual are of opposite polarity, yet intersect. The base [1-5:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-50.3.5, as derived from the application of a print to root-50.3.

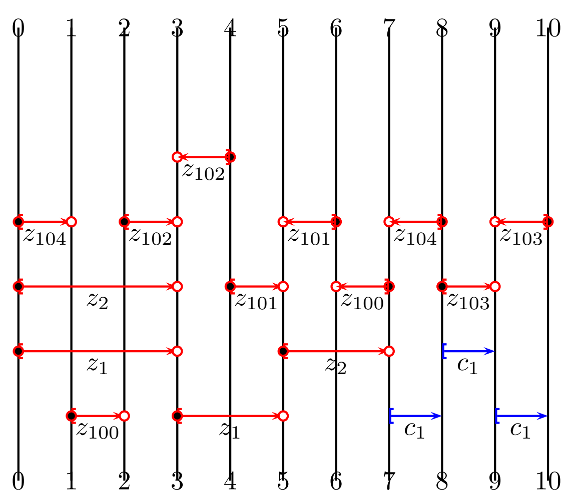
## 51 Cancellation scheme #51



| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 4 \leftarrow 0$ |
| $z_1$ | $3 \leftarrow 2 \leftarrow 1$ |
| $z_2$ | $4 \leftarrow 2 \leftarrow 3$ |
| $c_1$ | $0 \leftarrow 4$ |
| $c_1$ | $5 \leftarrow 0$ |
| $c_1$ | $0 \leftarrow 5$ |

### Generalized Equation root-51

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-3:z1+.] ; Carrier Dual: [3-5:z1+.] ; Critical Boundary: 3; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 4 valid prints (descendents).

It has 4 legal carrier-to-dual prints, as follows:

```
Print 1: =0=3*<1<2<4*<3=5*
Print 2: =0=3*<1=4*<2<3=5*
Print 3: =0=3*<1<4*<2<3=5*
Print 4: =0=3*<4*<1<2<3=5*
```

We proceed.

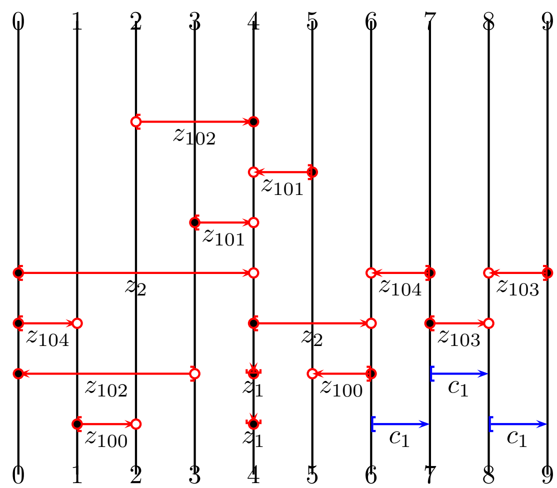
## Generalized Equation root-51.1

We begin from the GE root-51 (see pp. 279). We consider its print

```
Print 1: =0=3*<1<2<4*<3=5*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 5.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 5: Moved (old) base [1-2:z100+.] to (new) boundaries 4 - 5.
Step 6: Moved (old) base [2-3:z102+.] to (new) boundaries 5 - 7.
Step 7: Moved (old) base [0-1:z104+.] to (new) boundaries 3 - 4.
Step 8: Collapsed (new) base [3-7:z1+.] to the empty base (7,7).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-51.1—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-6:z2+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [2-4:z102+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-51.1, as derived from the application of a print to root-51.

## Generalized Equation root-51.2

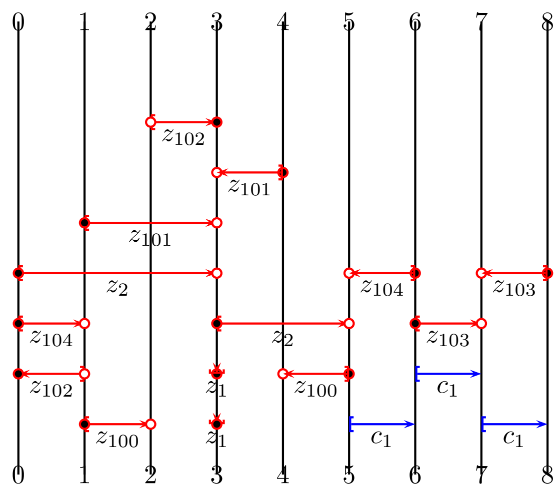
We begin from the GE root-51 (see pp. 279). We consider its print

```
Print 2: =0=3*<1=4*<2<3=5*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 5.
Step 2: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 6.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 6.
Step 4: Moved (old) base [1-2:z100+.] to (new) boundaries 4 - 5.
Step 5: Moved (old) base [2-3:z102+.] to (new) boundaries 5 - 6.
Step 6: Moved (old) base [0-1:z104+.] to (new) boundaries 3 - 4.
Step 7: Collapsed (new) base [3-6:z1+.] to the empty base (6,6).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-51.2—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-5:z2+.] ; Critical Boundary: 3; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 3 valid prints (descendents).

It has 3 legal carrier-to-dual prints, as follows:

```
Print 1: =0=3*<1<2<4*<3=5*
Print 2: =0=3*<1<4*<2<3=5*
Print 3: =0=3*<4*<1<2<3=5*
```

This completes the consideration of root-51.2, as derived from the application of a print to root-51.

## Generalized Equation root-51.3

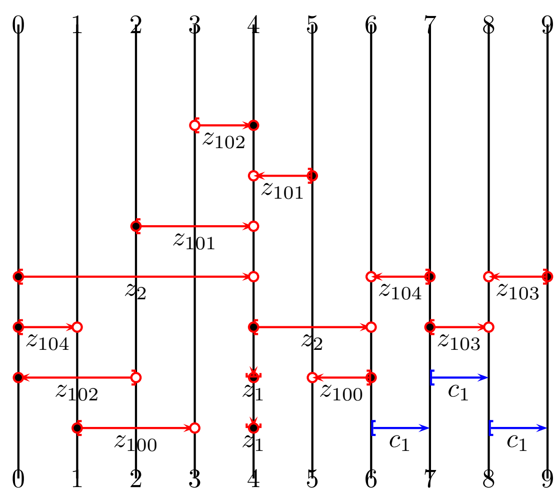
We begin from the GE root-51 (see pp. 279). We consider its print

```
Print 3: =0=3*<1<4*<2<3=5*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.

Step 5: Moved (old) base [1-2:z100+.] to (new) boundaries 4 - 6.
Step 6: Moved (old) base [2-3:z102+.] to (new) boundaries 6 - 7.
Step 7: Moved (old) base [0-1:z104+.] to (new) boundaries 3 - 4.
Step 8: Collapsed (new) base [3-7:z1+.] to the empty base (7,7).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-51.3—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-6:z2+.] ; Critical Boundary: 4; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 5 valid prints (descendents).

It has 5 legal carrier-to-dual prints, as follows:

```
Print 1: =0=4*<1<2<3<5*<4=6*
Print 2: =0=4*<1<2<5*<3<4=6*
Print 3: =0=4*<1=5*<2<3<4=6*
Print 4: =0=4*<1<5*<2<3<4=6*
Print 5: =0=4*<5*<1<2<3<4=6*
```

This completes the consideration of root-51.3, as derived from the application of a print to root-51.

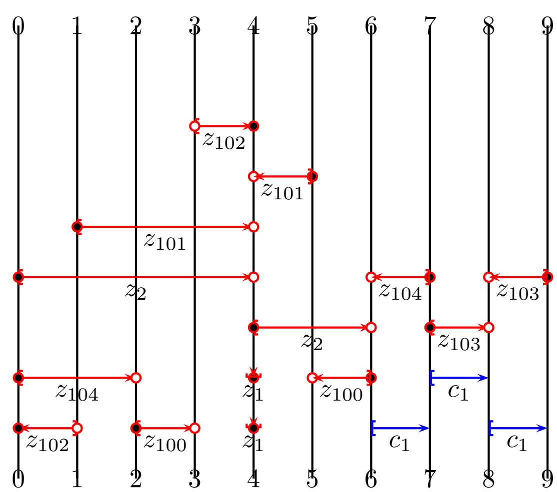
## Generalized Equation root-51.4

We begin from the GE root-51 (see pp. 279). We consider its print

```
Print 4: =0=3*<4*<1<2<3=5*
```

**Sequence of actions in performing the Print 4:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 5: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 6.
Step 6: Moved (old) base [2-3:z102+.] to (new) boundaries 6 - 7.
Step 7: Moved (old) base [0-1:z104+.] to (new) boundaries 3 - 5.
Step 8: Collapsed (new) base [3-7:z1+.] to the empty base (7,7).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-51.4—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-6:z2+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [6-7:z104-.] has constraints with its dual that stretch the constant segment 6 - 7 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-51.4, as derived from the application of a print to root-51.

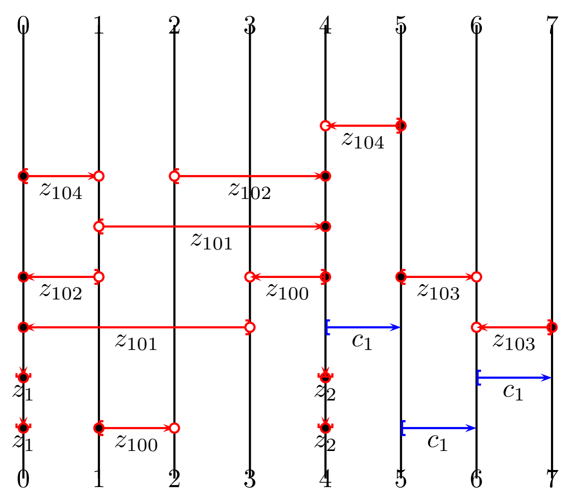
## Generalized Equation root-51.2.1

We begin from the GE root-51.2 (see pp. 281). We consider its print

```
Print 1: =0=3*<1<2<4*<3=5*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 5.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [1-2:z100+.] to (new) boundaries 4 - 5.
Step 5: Moved (old) base [1-3:z101+.] to (new) boundaries 4 - 7.
Step 6: Moved (old) base [2-3:z102+.] to (new) boundaries 5 - 7.
Step 7: Moved (old) base [0-1:z102-.] to (new) boundaries 3 - 4.
Step 8: Moved (old) base [0-1:z104+.] to (new) boundaries 3 - 4.
Step 9: Collapsed (new) base [3-7:z2+.] to the empty base (7,7).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-51.2.1—is illustrated below:



**GE Information**: Carrier: [0-3:z101-.] ; Carrier Dual: [1-4:z101+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-4:z101+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-51.2.1, as derived from the application of a print to root-51.2.

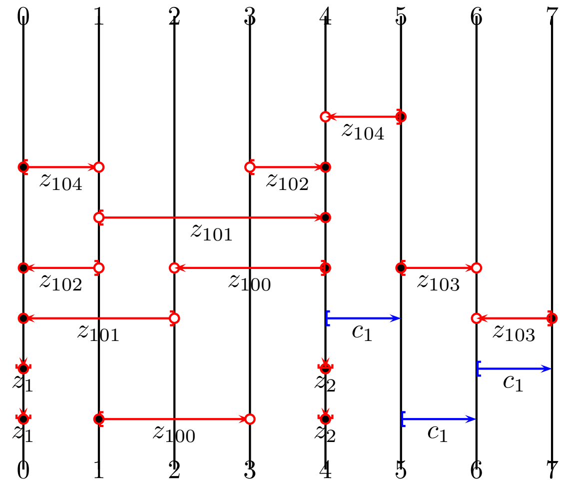
## Generalized Equation root-51.2.2

We begin from the GE root-51.2 (see pp. 281). We consider its print

```
Print 2: =0=3*<1<4*<2<3=5*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [1-2:z100+.] to (new) boundaries 4 - 6.
Step 5: Moved (old) base [1-3:z101+.] to (new) boundaries 4 - 7.
Step 6: Moved (old) base [2-3:z102+.] to (new) boundaries 6 - 7.
Step 7: Moved (old) base [0-1:z102-.] to (new) boundaries 3 - 4.
Step 8: Moved (old) base [0-1:z104+.] to (new) boundaries 3 - 4.
Step 9: Collapsed (new) base [3-7:z2+.] to the empty base (7,7).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-51.2.2—is illustrated below:




**GE Information**: Carrier: [0-2:z101-.] ; Carrier Dual: [1-4:z101+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-3:z100+.] and its dual are of opposite polarity, yet intersect. The base [2-4:z100-.] and its dual are of opposite polarity, yet intersect. The base [1-4:z101+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-51.2.2, as derived from the application of a print to root-51.2.

## Generalized Equation root-51.2.3

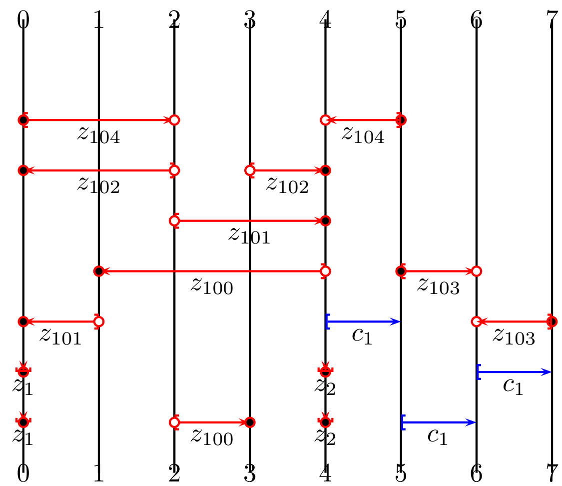
We begin from the GE root-51.2 (see pp. 281). We consider its print

```
Print 3: =0=3*<4*<1<2<3=5*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 6.
Step 5: Moved (old) base [1-3:z101+.] to (new) boundaries 5 - 7.
Step 6: Moved (old) base [2-3:z102+.] to (new) boundaries 6 - 7.
Step 7: Moved (old) base [0-1:z102-.] to (new) boundaries 3 - 5.
Step 8: Moved (old) base [0-1:z104+.] to (new) boundaries 3 - 5.
Step 9: Collapsed (new) base [3-7:z2+.] to the empty base (7,7).

Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-51.2.3—is illustrated below:




**GE Information**: Carrier: [0-2:z102-.] ; Carrier Dual: [3-4:z102+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [2-3:z100+.] and its dual are of opposite polarity, yet intersect. The base [1-4:z100-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-51.2.3, as derived from the application of a print to root-51.2.

## Generalized Equation root-51.3.1

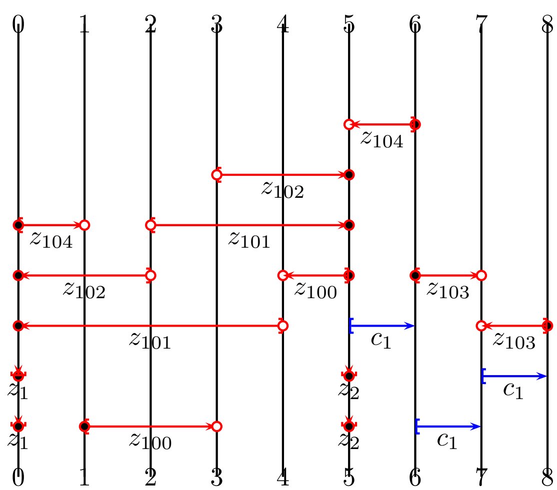
We begin from the GE root-51.3 (see pp. 282). We consider its print

```
Print 1: =0=4*<1<2<3<5*<4=6*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.

Step 3: Added (new) boundary 7.
Step 4: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [1-3:z100+.] to (new) boundaries 5 - 7.
Step 6: Moved (old) base [2-4:z101+.] to (new) boundaries 6 - 9.
Step 7: Moved (old) base [3-4:z102+.] to (new) boundaries 7 - 9.
Step 8: Moved (old) base [0-2:z102-.] to (new) boundaries 4 - 6.
Step 9: Moved (old) base [0-1:z104+.] to (new) boundaries 4 - 5.
Step 10: Collapsed (new) base [4-9:z2+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-51.3.1—is illustrated below:




**GE Information**: Carrier: [0-4:z101-.] ; Carrier Dual: [2-5:z101+.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [2-5:z101+.] and its dual are of opposite polarity, yet intersect. The base [0-4:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-51.3.1, as derived from the application of a print to root-51.3.

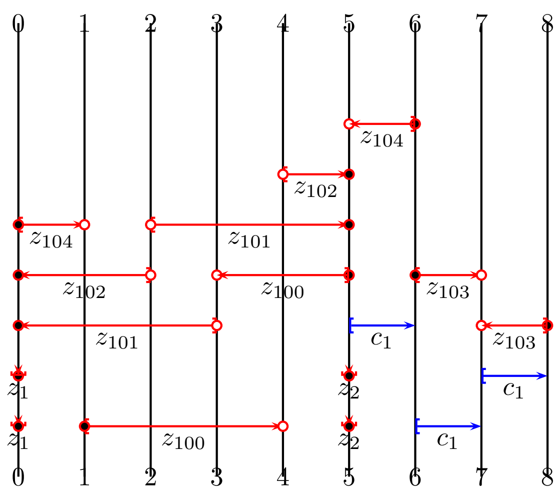
## Generalized Equation root-51.3.2

We begin from the GE root-51.3 (see pp. 282). We consider its print

```
Print 2: =0=4*<1<2<5*<3<4=6*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Added (new) boundary 8.
Step 4: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [1-3:z100+.] to (new) boundaries 5 - 8.
Step 6: Moved (old) base [2-4:z101+.] to (new) boundaries 6 - 9.
Step 7: Moved (old) base [3-4:z102+.] to (new) boundaries 8 - 9.
Step 8: Moved (old) base [0-2:z102-.] to (new) boundaries 4 - 6.
Step 9: Moved (old) base [0-1:z104+.] to (new) boundaries 4 - 5.
Step 10: Collapsed (new) base [4-9:z2+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-51.3.2—is illustrated below:



**GE Information**: Carrier: [0-3:z101-.] ; Carrier Dual: [2-5:z101+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-4:z100+.] and its dual are of opposite polarity, yet intersect. The base [3-5:z100-.] and its dual are of opposite polarity, yet intersect. The base [2-5:z101+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-51.3.2, as derived from the application of a print to root-51.3.

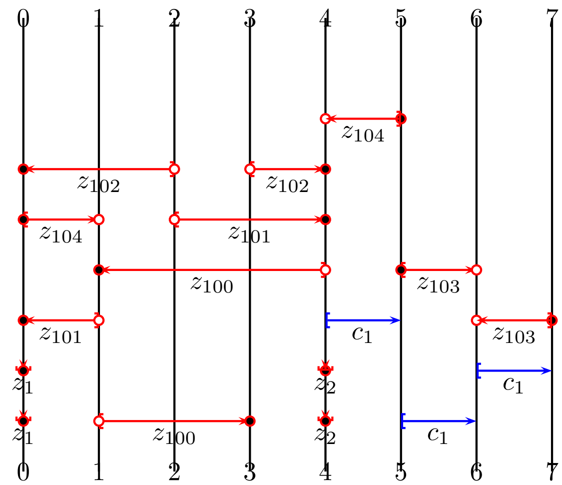
## Generalized Equation root-51.3.3

We begin from the GE root-51.3 (see pp. 282). We consider its print

```
Print 3: =0=4*<1=5*<2<3<4=6*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 8.
Step 4: Moved (old) base [1-3:z100+.] to (new) boundaries 5 - 7.
Step 5: Moved (old) base [2-4:z101+.] to (new) boundaries 6 - 8.
Step 6: Moved (old) base [3-4:z102+.] to (new) boundaries 7 - 8.
Step 7: Moved (old) base [0-2:z102-.] to (new) boundaries 4 - 6.
Step 8: Moved (old) base [0-1:z104+.] to (new) boundaries 4 - 5.
Step 9: Collapsed (new) base [4-8:z2+.] to the empty base (8,8).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-51.3.3—is illustrated below:




**GE Information**: Carrier: [0-2:z102-.] ; Carrier Dual: [3-4:z102+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-3:z100+.] and its dual are of opposite polarity, yet intersect. The base [1-4:z100-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-51.3.3, as derived from the application of a print to root-51.3.

## Generalized Equation root-51.3.4

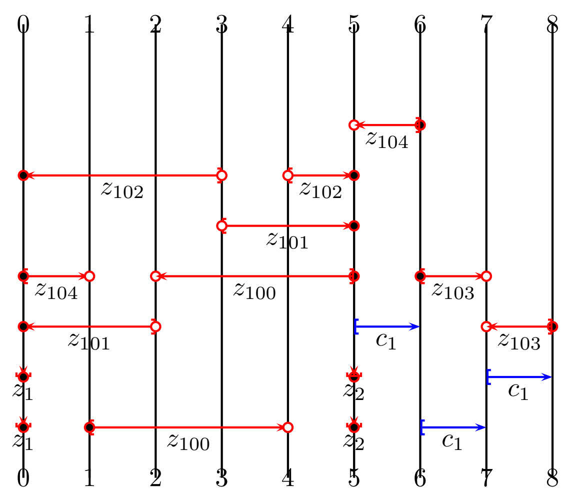
We begin from the GE root-51.3 (see pp. 282). We consider its print

```
Print 4: =0=4*<1<5*<2<3<4=6*
```

**Sequence of actions in performing the Print 4:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 7.
Step 3: Added (new) boundary 8.
Step 4: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [1-3:z100+.] to (new) boundaries 5 - 8.
Step 6: Moved (old) base [2-4:z101+.] to (new) boundaries 7 - 9.
Step 7: Moved (old) base [3-4:z102+.] to (new) boundaries 8 - 9.
Step 8: Moved (old) base [0-2:z102-.] to (new) boundaries 4 - 7.
Step 9: Moved (old) base [0-1:z104+.] to (new) boundaries 4 - 5.
Step 10: Collapsed (new) base [4-9:z2+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This

will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-51.3.4—is illustrated below:




**GE Information**: Carrier: [0-3:z102-.] ; Carrier Dual: [4-5:z102+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-4:z100+.] and its dual are of opposite polarity, yet intersect. The base [2-5:z100-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-51.3.4, as derived from the application of a print to root-51.3.

## Generalized Equation root-51.3.5

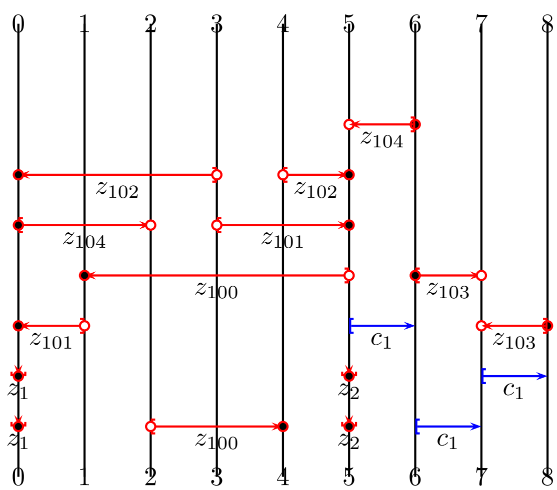
We begin from the GE root-51.3 (see pp. 282). We consider its print

```
Print 5: =0=4*<5*<1<2<3<4=6*
```

**Sequence of actions in performing the Print 5:**
Step 1: Added (new) boundary 6.

Step 2: Added (new) boundary 7.
Step 3: Added (new) boundary 8.
Step 4: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [1-3:z100+.] to (new) boundaries 6 - 8.
Step 6: Moved (old) base [2-4:z101+.] to (new) boundaries 7 - 9.
Step 7: Moved (old) base [3-4:z102+.] to (new) boundaries 8 - 9.
Step 8: Moved (old) base [0-2:z102-.] to (new) boundaries 4 - 7.
Step 9: Moved (old) base [0-1:z104+.] to (new) boundaries 4 - 6.
Step 10: Collapsed (new) base [4-9:z2+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-51.3.5—is illustrated below:

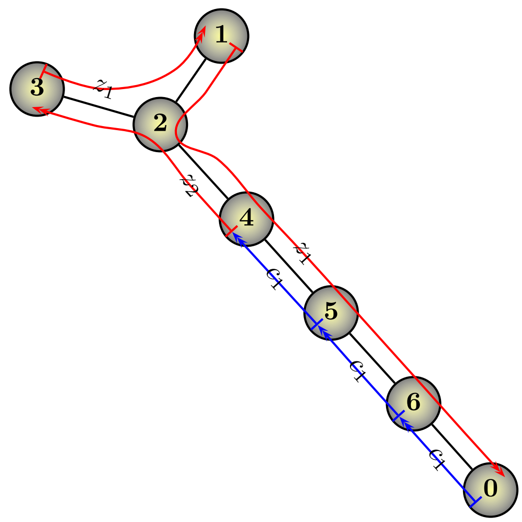



**GE Information**: Carrier: [0-3:z102-.] ; Carrier Dual: [4-5:z102+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [2-4:z100+.] and its dual are of opposite polarity, yet intersect. The base [1-5:z100-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-51.3.5, as derived from the application of a print to root-51.3.

$$z_1 z_1 z_1 c_1 c_1 c_1 =_F 1$$

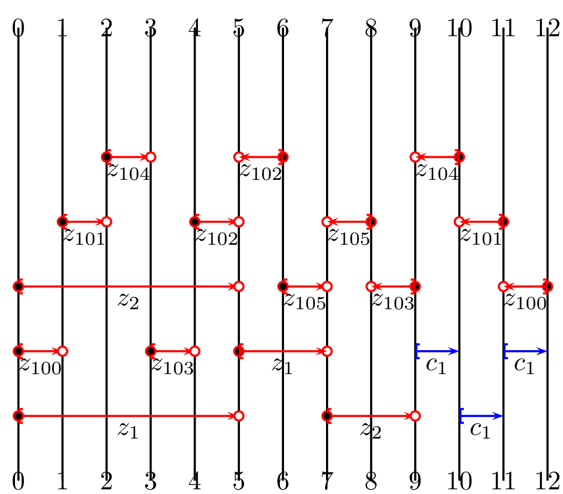
# 52 Cancellation scheme #52




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 4 \leftarrow 5 \leftarrow 6 \leftarrow 0$ |
| $z_1$ | $3 \leftarrow 2 \leftarrow 1$ |
| $z_2$ | $4 \leftarrow 2 \leftarrow 3$ |
| $c_1$ | $5 \leftarrow 4$ |
| $c_1$ | $6 \leftarrow 5$ |
| $c_1$ | $0 \leftarrow 6$ |

## Generalized Equation root-52

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-5:z1+.] ; Carrier Dual: [5-7:z1+.] ; Critical Boundary: 5; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 8 valid prints (descendents).

It has 8 legal carrier-to-dual prints, as follows:

```
Print 1: =0=5*<1<2<3<4<6*<5=7*
Print 2: =0=5*<1<2<3=6*<4<5=7*
Print 3: =0=5*<1<2<3<6*<4<5=7*
Print 4: =0=5*<1<2=6*<3<4<5=7*
Print 5: =0=5*<1<2<6*<3<4<5=7*
Print 6: =0=5*<1=6*<2<3<4<5=7*
Print 7: =0=5*<1<6*<2<3<4<5=7*
Print 8: =0=5*<6*<1<2<3<4<5=7*
```

We proceed.

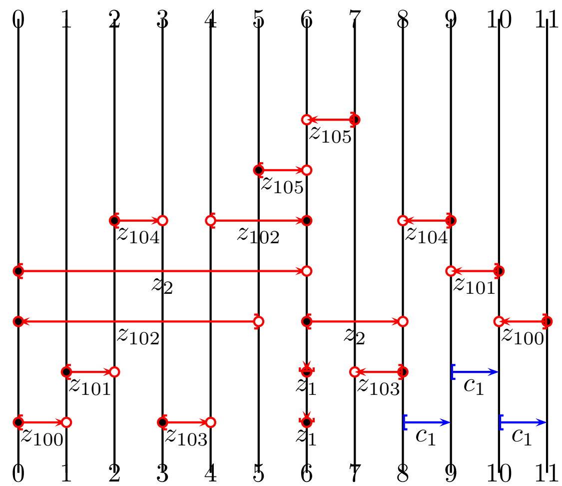
## Generalized Equation root-52.1

We begin from the GE root-52 (see pp. 296). We consider its print

```
Print 1: =0=5*<1<2<3<4<6*<5=7*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 7.
Step 3: Added (new) boundary 8.
Step 4: Added (new) boundary 9.
Step 5: Moved (old) base [0-5:z1+.] to (new) boundaries 5 - 11.
Step 6: Moved (old) base [0-5:z2+.] to (new) boundaries 5 - 11.
Step 7: Moved (old) base [0-1:z100+.] to (new) boundaries 5 - 6.
Step 8: Moved (old) base [1-2:z101+.] to (new) boundaries 6 - 7.
Step 9: Moved (old) base [4-5:z102+.] to (new) boundaries 9 - 11.
Step 10: Moved (old) base [3-4:z103+.] to (new) boundaries 8 - 9.
Step 11: Moved (old) base [2-3:z104+.] to (new) boundaries 7 - 8.
Step 12: Collapsed (new) base [5-11:z1+.] to the empty base (11,11).
Step 13: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 15: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 16: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 17: Deleted (new) boundary 4 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-52.1—is illustrated below:




**GE Information**: Carrier: [0-6:z2+.] ; Carrier Dual: [6-8:z2+.] ; Critical Boundary: 6; Observe the following facts about this GE: The base [4-6:z102+.] and its dual are of opposite polarity, yet intersect. The base [0-5:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-52.1, as derived from the application of a print to root-52.

## Generalized Equation root-52.2

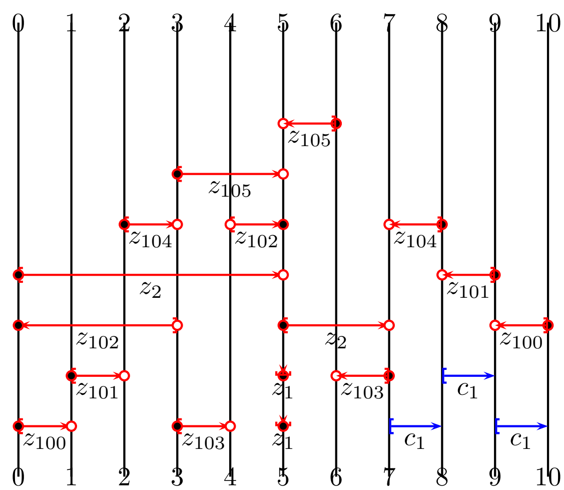
We begin from the GE root-52 (see pp. 296). We consider its print

```
Print 2: =0=5*<1<2<3=6*<4<5=7*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 7.
Step 3: Added (new) boundary 9.
Step 4: Moved (old) base [0-5:z1+.] to (new) boundaries 5 - 10.
Step 5: Moved (old) base [0-5:z2+.] to (new) boundaries 5 - 10.
Step 6: Moved (old) base [0-1:z100+.] to (new) boundaries 5 - 6.
Step 7: Moved (old) base [1-2:z101+.] to (new) boundaries 6 - 7.
Step 8: Moved (old) base [4-5:z102+.] to (new) boundaries 9 - 10.
Step 9: Moved (old) base [3-4:z103+.] to (new) boundaries 8 - 9.

Step 10: Moved (old) base [2-3:z104+.] to (new) boundaries 7 - 8.
Step 11: Collapsed (new) base [5-10:z1+.] to the empty base (10,10).
Step 12: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 15: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 16: Deleted (new) boundary 4 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-52.2—is illustrated below:




**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-7:z2+.] ; Critical Boundary: 5; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 7 valid prints (descendents).

It has 7 legal carrier-to-dual prints, as follows:

```
Print 1: =0=5*<1<2<3<4<6*<5=7*
Print 2: =0=5*<1<2<3<6*<4<5=7*
Print 3: =0=5*<1<2=6*<3<4<5=7*
Print 4: =0=5*<1<2<6*<3<4<5=7*
Print 5: =0=5*<1=6*<2<3<4<5=7*
Print 6: =0=5*<1<6*<2<3<4<5=7*
Print 7: =0=5*<6*<1<2<3<4<5=7*
```

This completes the consideration of root-52.2, as derived from the application of a print to root-52.

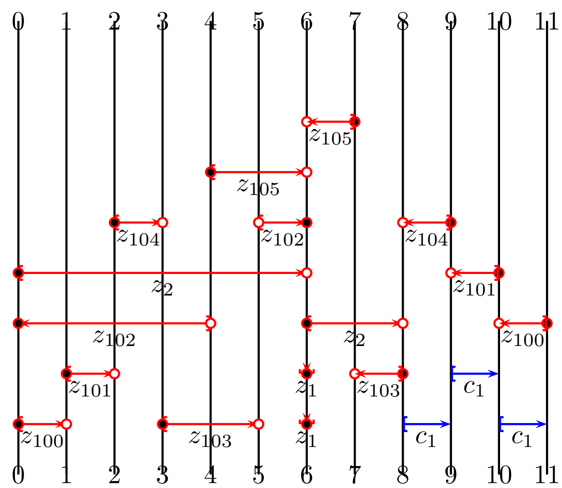
## Generalized Equation root-52.3

We begin from the GE root-52 (see pp. 296). We consider its print

```
Print 3: =0=5*<1<2<3<6*<4<5=7*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 7.
Step 3: Added (new) boundary 8.
Step 4: Added (new) boundary 10.
Step 5: Moved (old) base [0-5:z1+.] to (new) boundaries 5 - 11.
Step 6: Moved (old) base [0-5:z2+.] to (new) boundaries 5 - 11.
Step 7: Moved (old) base [0-1:z100+.] to (new) boundaries 5 - 6.
Step 8: Moved (old) base [1-2:z101+.] to (new) boundaries 6 - 7.
Step 9: Moved (old) base [4-5:z102+.] to (new) boundaries 10 - 11.
Step 10: Moved (old) base [3-4:z103+.] to (new) boundaries 8 - 10.
Step 11: Moved (old) base [2-3:z104+.] to (new) boundaries 7 - 8.
Step 12: Collapsed (new) base [5-11:z1+.] to the empty base (11,11).
Step 13: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 15: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 16: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 17: Deleted (new) boundary 4 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-52.3—is illustrated below:




**GE Information**: Carrier: [0-6:z2+.] ; Carrier Dual: [6-8:z2+.] ; Critical Boundary: 6; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 9 valid prints (descendents).

It has 9 legal carrier-to-dual prints, as follows:

```
Print 1: =0=6*<1<2<3<4<5<7*<6=8*
Print 2: =0=6*<1<2<3<4<7*<5<6=8*
Print 3: =0=6*<1<2<3=7*<4<5<6=8*
Print 4: =0=6*<1<2<3<7*<4<5<6=8*
Print 5: =0=6*<1<2=7*<3<4<5<6=8*
Print 6: =0=6*<1<2<7*<3<4<5<6=8*
Print 7: =0=6*<1=7*<2<3<4<5<6=8*
Print 8: =0=6*<1<7*<2<3<4<5<6=8*
Print 9: =0=6*<7*<1<2<3<4<5<6=8*
```

This completes the consideration of root-52.3, as derived from the application of a print to root-52.

## Generalized Equation root-52.4

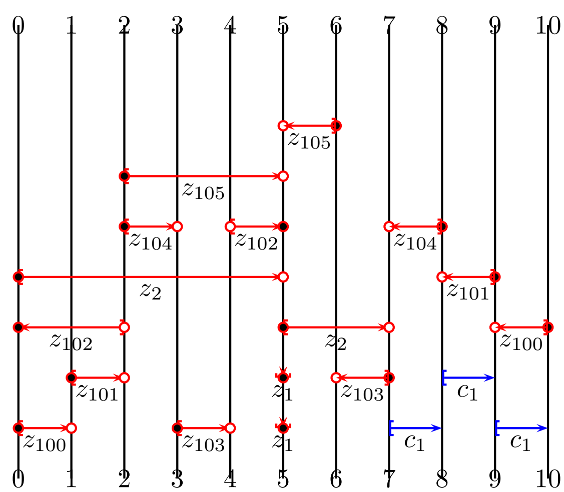
We begin from the GE root-52 (see pp. 296). We consider its print

```
Print 4: =0=5*<1<2=6*<3<4<5=7*
```

**Sequence of actions in performing the Print 4:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 8.
Step 3: Added (new) boundary 9.

Step 4: Moved (old) base [0-5:z1+.] to (new) boundaries 5 - 10.
Step 5: Moved (old) base [0-5:z2+.] to (new) boundaries 5 - 10.
Step 6: Moved (old) base [0-1:z100+.] to (new) boundaries 5 - 6.
Step 7: Moved (old) base [1-2:z101+.] to (new) boundaries 6 - 7.
Step 8: Moved (old) base [4-5:z102+.] to (new) boundaries 9 - 10.
Step 9: Moved (old) base [3-4:z103+.] to (new) boundaries 8 - 9.
Step 10: Moved (old) base [2-3:z104+.] to (new) boundaries 7 - 8.
Step 11: Collapsed (new) base [5-10:z1+.] to the empty base (10,10).
Step 12: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 15: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 16: Deleted (new) boundary 4 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-52.4—is illustrated below:




**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-7:z2+.] ; Critical Boundary: 5; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 7 valid prints (descendents).

It has 7 legal carrier-to-dual prints, as follows:

```
Print 1: =0=5*<1<2<3<4<6*<5=7*
Print 2: =0=5*<1<2<3=6*<4<5=7*
```

```
Print 3: =0=5*<1<2<3<6*<4<5=7*
Print 4: =0=5*<1<2<6*<3<4<5=7*
Print 5: =0=5*<1=6*<2<3<4<5=7*
Print 6: =0=5*<1<6*<2<3<4<5=7*
Print 7: =0=5*<6*<1<2<3<4<5=7*
```

This completes the consideration of root-52.4, as derived from the application of a print to root-52.

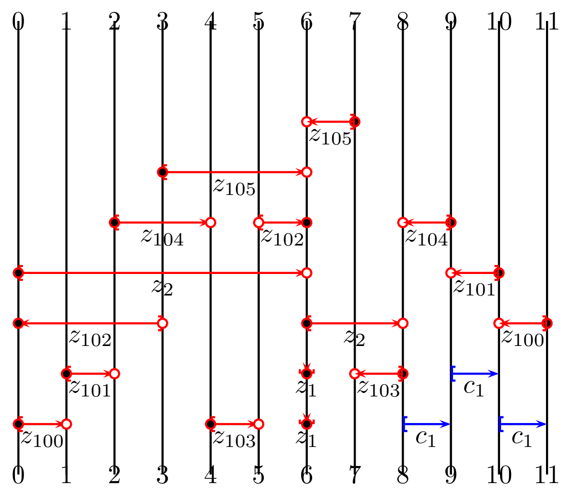
## Generalized Equation root-52.5

We begin from the GE root-52 (see pp. 296). We consider its print

```
Print 5: =0=5*<1<2<6*<3<4<5=7*
```

**Sequence of actions in performing the Print 5:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 7.
Step 3: Added (new) boundary 9.
Step 4: Added (new) boundary 10.
Step 5: Moved (old) base [0-5:z1+.] to (new) boundaries 5 - 11.
Step 6: Moved (old) base [0-5:z2+.] to (new) boundaries 5 - 11.
Step 7: Moved (old) base [0-1:z100+.] to (new) boundaries 5 - 6.
Step 8: Moved (old) base [1-2:z101+.] to (new) boundaries 6 - 7.
Step 9: Moved (old) base [4-5:z102+.] to (new) boundaries 10 - 11.
Step 10: Moved (old) base [3-4:z103+.] to (new) boundaries 9 - 10.
Step 11: Moved (old) base [2-3:z104+.] to (new) boundaries 7 - 9.
Step 12: Collapsed (new) base [5-11:z1+.] to the empty base (11,11).
Step 13: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 15: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 16: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 17: Deleted (new) boundary 4 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-52.5—is illustrated below:




**GE Information**: Carrier: [0-6:z2+.] ; Carrier Dual: [6-8:z2+.] ; Critical Boundary: 6; Observe the following facts about this GE: The base [8-9:z104-.] has constraints with its dual that stretch the constant segment 8 - 9 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-52.5, as derived from the application of a print to root-52.

## Generalized Equation root-52.6

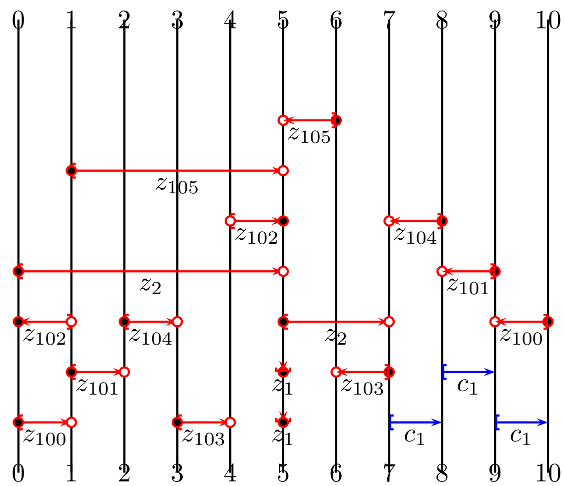
We begin from the GE root-52 (see pp. 296). We consider its print

```
Print 6: =0=5*<1=6*<2<3<4<5=7*
```

**Sequence of actions in performing the Print 6:**
Step 1: Added (new) boundary 7.
Step 2: Added (new) boundary 8.
Step 3: Added (new) boundary 9.
Step 4: Moved (old) base [0-5:z1+.] to (new) boundaries 5 - 10.
Step 5: Moved (old) base [0-5:z2+.] to (new) boundaries 5 - 10.
Step 6: Moved (old) base [0-1:z100+.] to (new) boundaries 5 - 6.
Step 7: Moved (old) base [1-2:z101+.] to (new) boundaries 6 - 7.
Step 8: Moved (old) base [4-5:z102+.] to (new) boundaries 9 - 10.
Step 9: Moved (old) base [3-4:z103+.] to (new) boundaries 8 - 9.
Step 10: Moved (old) base [2-3:z104+.] to (new) boundaries 7 - 8.
Step 11: Collapsed (new) base [5-10:z1+.] to the empty base (10,10).

Step 12: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 15: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 16: Deleted (new) boundary 4 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-52.6—is illustrated below:




**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-7:z2+.] ; Critical Boundary: 5; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 7 valid prints (descendents).

It has 7 legal carrier-to-dual prints, as follows:

```
Print 1: =0=5*<1<2<3<4<6*<5=7*
Print 2: =0=5*<1<2<3=6*<4<5=7*
Print 3: =0=5*<1<2<3<6*<4<5=7*
Print 4: =0=5*<1<2=6*<3<4<5=7*
Print 5: =0=5*<1<2<6*<3<4<5=7*
Print 6: =0=5*<1<6*<2<3<4<5=7*
Print 7: =0=5*<6*<1<2<3<4<5=7*
```

This completes the consideration of root-52.6, as derived from the application of a print to root-52.

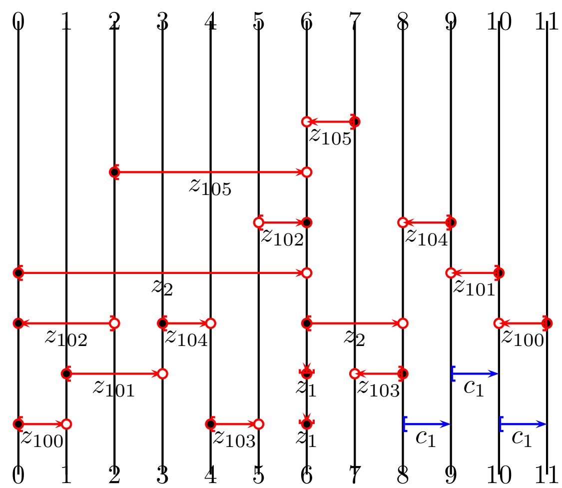
## Generalized Equation root-52.7

We begin from the GE root-52 (see pp. 296). We consider its print

```
Print 7: =0=5*<1<6*<2<3<4<5=7*
```

**Sequence of actions in performing the Print 7:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 8.
Step 3: Added (new) boundary 9.
Step 4: Added (new) boundary 10.
Step 5: Moved (old) base [0-5:z1+.] to (new) boundaries 5 - 11.
Step 6: Moved (old) base [0-5:z2+.] to (new) boundaries 5 - 11.
Step 7: Moved (old) base [0-1:z100+.] to (new) boundaries 5 - 6.
Step 8: Moved (old) base [1-2:z101+.] to (new) boundaries 6 - 8.
Step 9: Moved (old) base [4-5:z102+.] to (new) boundaries 10 - 11.
Step 10: Moved (old) base [3-4:z103+.] to (new) boundaries 9 - 10.
Step 11: Moved (old) base [2-3:z104+.] to (new) boundaries 8 - 9.
Step 12: Collapsed (new) base [5-11:z1+.] to the empty base (11,11).
Step 13: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 15: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 16: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 17: Deleted (new) boundary 4 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-52.7—is illustrated below:




**GE Information**: Carrier: [0-6:z2+.] ; Carrier Dual: [6-8:z2+.] ; Critical Boundary: 6; Observe the following facts about this GE: The base [9-10:z101-.] has constraints with its dual that stretch the constant segment 9 - 10 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-52.7, as derived from the application of a print to root-52.

## Generalized Equation root-52.8

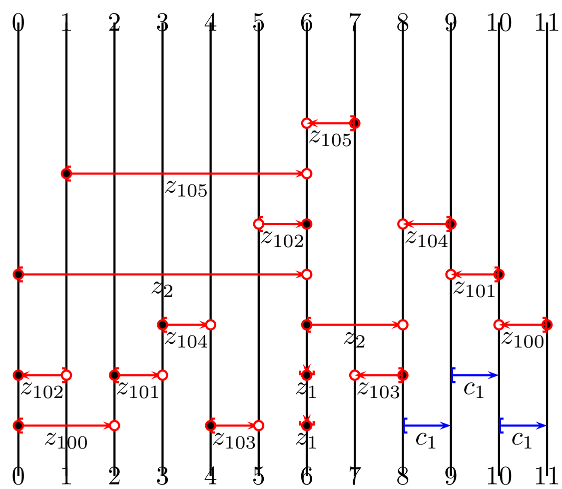
We begin from the GE root-52 (see pp. 296). We consider its print

```
Print 8: =0=5*<6*<1<2<3<4<5=7*
```

**Sequence of actions in performing the Print 8:**
Step 1: Added (new) boundary 7.
Step 2: Added (new) boundary 8.
Step 3: Added (new) boundary 9.
Step 4: Added (new) boundary 10.
Step 5: Moved (old) base [0-5:z1+.] to (new) boundaries 5 - 11.
Step 6: Moved (old) base [0-5:z2+.] to (new) boundaries 5 - 11.
Step 7: Moved (old) base [0-1:z100+.] to (new) boundaries 5 - 7.
Step 8: Moved (old) base [1-2:z101+.] to (new) boundaries 7 - 8.
Step 9: Moved (old) base [4-5:z102+.] to (new) boundaries 10 - 11.
Step 10: Moved (old) base [3-4:z103+.] to (new) boundaries 9 - 10.
Step 11: Moved (old) base [2-3:z104+.] to (new) boundaries 8 - 9.

Step 12: Collapsed (new) base [5-11:z1+.] to the empty base (11,11).
Step 13: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 15: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 16: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 17: Deleted (new) boundary 4 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-52.8—is illustrated below:




**GE Information**: Carrier: [0-6:z2+.] ; Carrier Dual: [6-8:z2+.] ; Critical Boundary: 6; Observe the following facts about this GE: The base [10-11:z100-.] has constraints with its dual that stretch the constant segment 10 - 11 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-52.8, as derived from the application of a print to root-52.

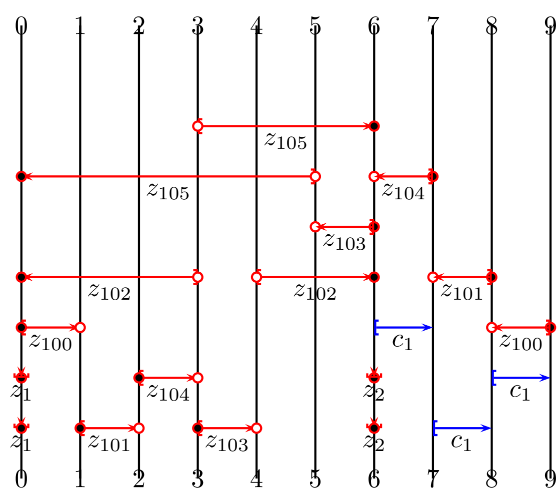
## Generalized Equation root-52.2.1

We begin from the GE root-52.2 (see pp. 298). We consider its print

```
Print 1: =0=5*<1<2<3<4<6*<5=7*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 7.
Step 3: Added (new) boundary 8.
Step 4: Added (new) boundary 9.
Step 5: Moved (old) base [0-5:z2+.] to (new) boundaries 5 - 11.
Step 6: Moved (old) base [0-1:z100+.] to (new) boundaries 5 - 6.
Step 7: Moved (old) base [1-2:z101+.] to (new) boundaries 6 - 7.
Step 8: Moved (old) base [4-5:z102+.] to (new) boundaries 9 - 11.
Step 9: Moved (old) base [0-3:z102-.] to (new) boundaries 5 - 8.
Step 10: Moved (old) base [3-4:z103+.] to (new) boundaries 8 - 9.
Step 11: Moved (old) base [2-3:z104+.] to (new) boundaries 7 - 8.
Step 12: Moved (old) base [3-5:z105+.] to (new) boundaries 8 - 11.
Step 13: Collapsed (new) base [5-11:z2+.] to the empty base (11,11).
Step 14: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 15: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 16: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 17: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 18: Deleted (new) boundary 4 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-52.2.1—is illustrated below:



**GE Information**: Carrier: [0-5:z105-.] ; Carrier Dual: [3-6:z105+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [3-6:z105+.] and its dual are of opposite polarity, yet intersect. The base [0-5:z105-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-52.2.1, as derived from the application of a print to root-52.2.

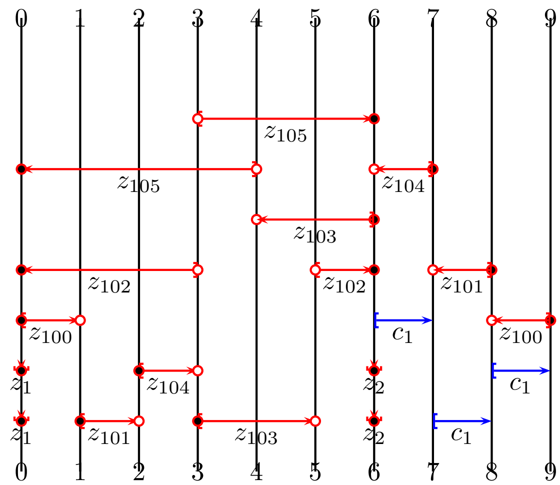
## Generalized Equation root-52.2.2

We begin from the GE root-52.2 (see pp. 298). We consider its print

```
Print 2: =0=5*<1<2<3<6*<4<5=7*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 7.
Step 3: Added (new) boundary 8.
Step 4: Added (new) boundary 10.
Step 5: Moved (old) base [0-5:z2+.] to (new) boundaries 5 - 11.
Step 6: Moved (old) base [0-1:z100+.] to (new) boundaries 5 - 6.
Step 7: Moved (old) base [1-2:z101+.] to (new) boundaries 6 - 7.
Step 8: Moved (old) base [4-5:z102+.] to (new) boundaries 10 - 11.
Step 9: Moved (old) base [0-3:z102-.] to (new) boundaries 5 - 8.
Step 10: Moved (old) base [3-4:z103+.] to (new) boundaries 8 - 10.
Step 11: Moved (old) base [2-3:z104+.] to (new) boundaries 7 - 8.
Step 12: Moved (old) base [3-5:z105+.] to (new) boundaries 8 - 11.
Step 13: Collapsed (new) base [5-11:z2+.] to the empty base (11,11).
Step 14: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 15: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 16: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 17: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 18: Deleted (new) boundary 4 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-52.2.2—is illustrated below:




**GE Information**: Carrier: [0-4:z105-.] ; Carrier Dual: [3-6:z105+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [3-5:z103+.] and its dual are of opposite polarity, yet intersect. The base [4-6:z103-.] and its dual are of opposite polarity, yet intersect. The base [3-6:z105+.] and its dual are of opposite polarity, yet intersect. The base [0-4:z105-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-52.2.2, as derived from the application of a print to root-52.2.

## Generalized Equation root-52.2.3

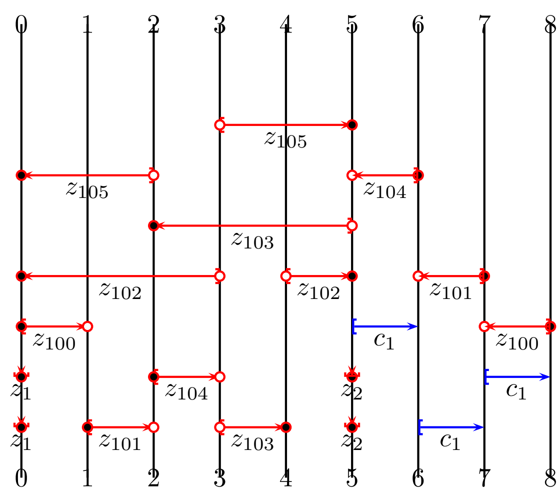
We begin from the GE root-52.2 (see pp. 298). We consider its print

```
Print 3: =0=5*<1<2=6*<3<4<5=7*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 8.
Step 3: Added (new) boundary 9.
Step 4: Moved (old) base [0-5:z2+.] to (new) boundaries 5 - 10.
Step 5: Moved (old) base [0-1:z100+.] to (new) boundaries 5 - 6.
Step 6: Moved (old) base [1-2:z101+.] to (new) boundaries 6 - 7.
Step 7: Moved (old) base [4-5:z102+.] to (new) boundaries 9 - 10.
Step 8: Moved (old) base [0-3:z102-.] to (new) boundaries 5 - 8.
Step 9: Moved (old) base [3-4:z103+.] to (new) boundaries 8 - 9.

Step 10: Moved (old) base [2-3:z104+.] to (new) boundaries 7 - 8.
Step 11: Moved (old) base [3-5:z105+.] to (new) boundaries 8 - 10.
Step 12: Collapsed (new) base [5-10:z2+.] to the empty base (10,10).
Step 13: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 15: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 16: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 17: Deleted (new) boundary 4 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-52.2.3—is illustrated below:




**GE Information**: Carrier: [0-3:z102-.] ; Carrier Dual: [4-5:z102+.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [3-4:z103+.] and its dual are of opposite polarity, yet intersect. The base [2-5:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-52.2.3, as derived from the application of a print to root-52.2.

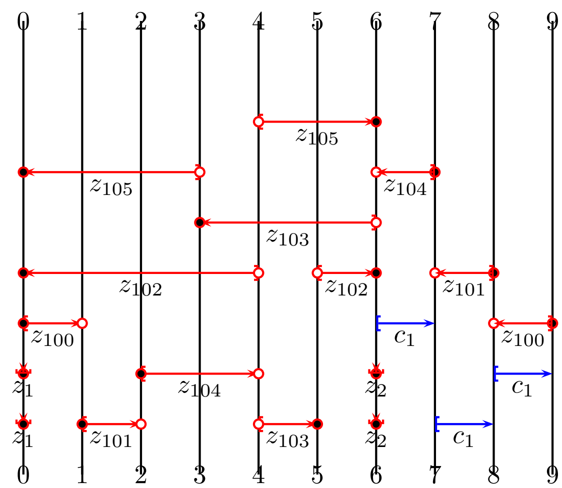
## Generalized Equation root-52.2.4

We begin from the GE root-52.2 (see pp. 298). We consider its print

```
Print 4: =0=5*<1<2<6*<3<4<5=7*
```

**Sequence of actions in performing the Print 4:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 7.
Step 3: Added (new) boundary 9.
Step 4: Added (new) boundary 10.
Step 5: Moved (old) base [0-5:z2+.] to (new) boundaries 5 - 11.
Step 6: Moved (old) base [0-1:z100+.] to (new) boundaries 5 - 6.
Step 7: Moved (old) base [1-2:z101+.] to (new) boundaries 6 - 7.
Step 8: Moved (old) base [4-5:z102+.] to (new) boundaries 10 - 11.
Step 9: Moved (old) base [0-3:z102-.] to (new) boundaries 5 - 9.
Step 10: Moved (old) base [3-4:z103+.] to (new) boundaries 9 - 10.
Step 11: Moved (old) base [2-3:z104+.] to (new) boundaries 7 - 9.
Step 12: Moved (old) base [3-5:z105+.] to (new) boundaries 9 - 11.
Step 13: Collapsed (new) base [5-11:z2+.] to the empty base (11,11).
Step 14: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 15: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 16: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 17: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 18: Deleted (new) boundary 4 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-52.2.4—is illustrated below:




**GE Information**: Carrier: [0-4:z102-.] ; Carrier Dual: [5-6:z102+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [4-5:z103+.] and its dual are of opposite polarity, yet intersect. The base [3-6:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-52.2.4, as derived from the application of a print to root-52.2.

## Generalized Equation root-52.2.5

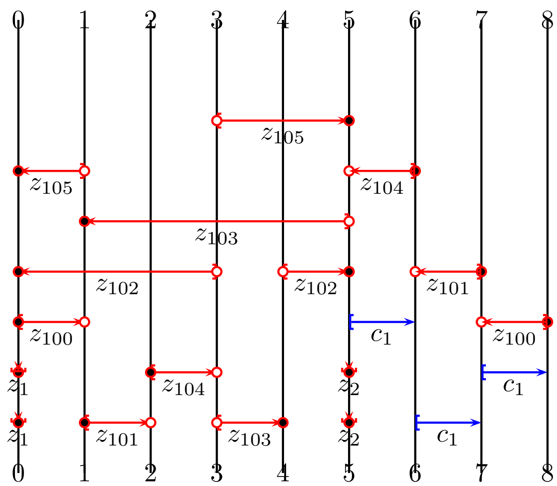
We begin from the GE root-52.2 (see pp. 298). We consider its print

```
Print 5: =0=5*<1=6*<2<3<4<5=7*
```

**Sequence of actions in performing the Print 5:**
Step 1: Added (new) boundary 7.
Step 2: Added (new) boundary 8.
Step 3: Added (new) boundary 9.
Step 4: Moved (old) base [0-5:z2+.] to (new) boundaries 5 - 10.
Step 5: Moved (old) base [0-1:z100+.] to (new) boundaries 5 - 6.
Step 6: Moved (old) base [1-2:z101+.] to (new) boundaries 6 - 7.
Step 7: Moved (old) base [4-5:z102+.] to (new) boundaries 9 - 10.
Step 8: Moved (old) base [0-3:z102-.] to (new) boundaries 5 - 8.
Step 9: Moved (old) base [3-4:z103+.] to (new) boundaries 8 - 9.
Step 10: Moved (old) base [2-3:z104+.] to (new) boundaries 7 - 8.
Step 11: Moved (old) base [3-5:z105+.] to (new) boundaries 8 - 10.

Step 12: Collapsed (new) base [5-10:z2+.] to the empty base (10,10).
Step 13: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 15: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 16: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 17: Deleted (new) boundary 4 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-52.2.5—is illustrated below:




**GE Information**: Carrier: [0-3:z102-.] ; Carrier Dual: [4-5:z102+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [3-4:z103+.] and its dual are of opposite polarity, yet intersect. The base [1-5:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-52.2.5, as derived from the application of a print to root-52.2.

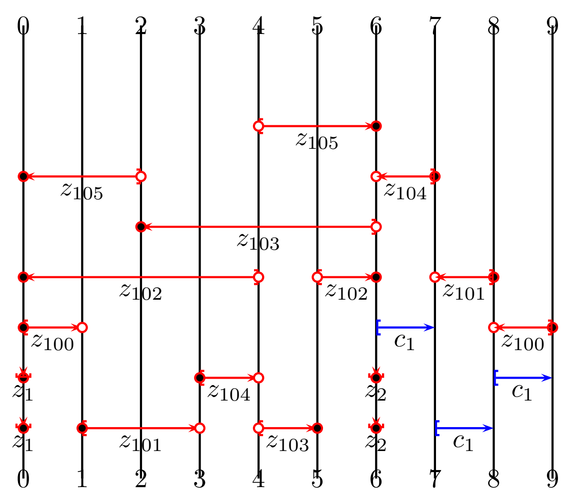
## Generalized Equation root-52.2.6

We begin from the GE root-52.2 (see pp. 298). We consider its print

```
Print 6: =0=5*<1<6*<2<3<4<5=7*
```

**Sequence of actions in performing the Print 6:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 8.
Step 3: Added (new) boundary 9.
Step 4: Added (new) boundary 10.
Step 5: Moved (old) base [0-5:z2+.] to (new) boundaries 5 - 11.
Step 6: Moved (old) base [0-1:z100+.] to (new) boundaries 5 - 6.
Step 7: Moved (old) base [1-2:z101+.] to (new) boundaries 6 - 8.
Step 8: Moved (old) base [4-5:z102+.] to (new) boundaries 10 - 11.
Step 9: Moved (old) base [0-3:z102-.] to (new) boundaries 5 - 9.
Step 10: Moved (old) base [3-4:z103+.] to (new) boundaries 9 - 10.
Step 11: Moved (old) base [2-3:z104+.] to (new) boundaries 8 - 9.
Step 12: Moved (old) base [3-5:z105+.] to (new) boundaries 9 - 11.
Step 13: Collapsed (new) base [5-11:z2+.] to the empty base (11,11).
Step 14: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 15: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 16: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 17: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 18: Deleted (new) boundary 4 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-52.2.6—is illustrated below:



**GE Information**: Carrier: [0-4:z102-.] ; Carrier Dual: [5-6:z102+.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [4-5:z103+.] and its dual are of opposite polarity, yet intersect. The base [2-6:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-52.2.6, as derived from the application of a print to root-52.2.

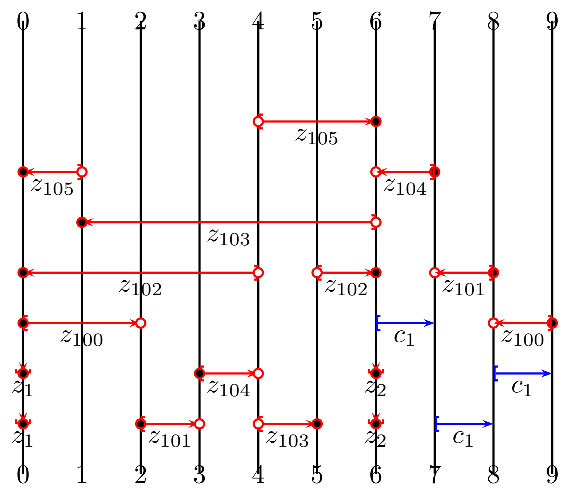
## Generalized Equation root-52.2.7

We begin from the GE root-52.2 (see pp. 298). We consider its print

```
Print 7: =0=5*<6*<1<2<3<4<5=7*
```

**Sequence of actions in performing the Print 7:**
Step 1: Added (new) boundary 7.
Step 2: Added (new) boundary 8.
Step 3: Added (new) boundary 9.
Step 4: Added (new) boundary 10.
Step 5: Moved (old) base [0-5:z2+.] to (new) boundaries 5 - 11.
Step 6: Moved (old) base [0-1:z100+.] to (new) boundaries 5 - 7.
Step 7: Moved (old) base [1-2:z101+.] to (new) boundaries 7 - 8.
Step 8: Moved (old) base [4-5:z102+.] to (new) boundaries 10 - 11.
Step 9: Moved (old) base [0-3:z102-.] to (new) boundaries 5 - 9.
Step 10: Moved (old) base [3-4:z103+.] to (new) boundaries 9 - 10.
Step 11: Moved (old) base [2-3:z104+.] to (new) boundaries 8 - 9.
Step 12: Moved (old) base [3-5:z105+.] to (new) boundaries 9 - 11.
Step 13: Collapsed (new) base [5-11:z2+.] to the empty base (11,11).
Step 14: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 15: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 16: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 17: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 18: Deleted (new) boundary 4 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

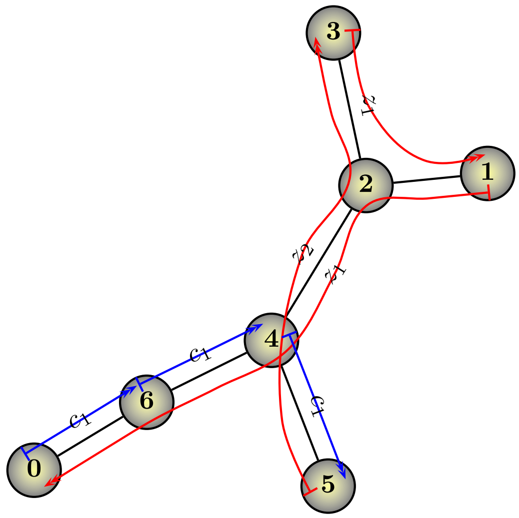
Upon applying the print, the GE we obtain—which we refer to as root-52.2.7—is illustrated below:




**GE Information**: Carrier: [0-4:z102-.] ; Carrier Dual: [5-6:z102+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [4-5:z103+.] and its dual are of opposite polarity, yet intersect. The base [1-6:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-52.2.7, as derived from the application of a print to root-52.2.

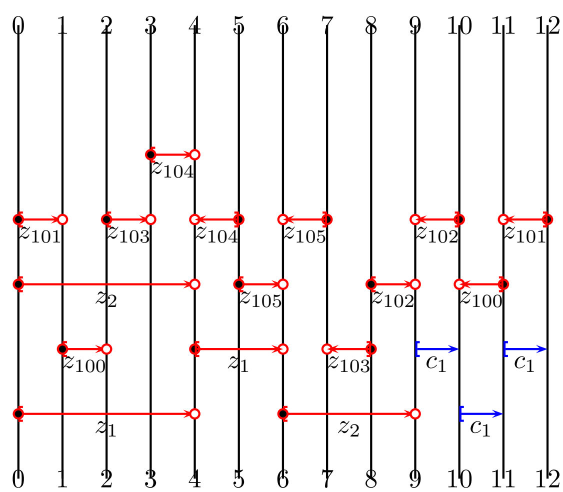
# 53 Cancellation scheme #53




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 4 \leftarrow 6 \leftarrow 0$ |
| $z_1$ | $3 \leftarrow 2 \leftarrow 1$ |
| $z_2$ | $5 \leftarrow 4 \leftarrow 2 \leftarrow 3$ |
| $c_1$ | $4 \leftarrow 5$ |
| $c_1$ | $6 \leftarrow 4$ |
| $c_1$ | $0 \leftarrow 6$ |

## Generalized Equation root-53

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-4:z1+.] ; Carrier Dual: [4-6:z1+.] ; Critical Boundary: 4; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 6 valid prints (descendents).

It has 6 legal carrier-to-dual prints, as follows:

```
Print 1: =0=4*<1<2<3<5*<4=6*
Print 2: =0=4*<1<2=5*<3<4=6*
Print 3: =0=4*<1<2<5*<3<4=6*
Print 4: =0=4*<1=5*<2<3<4=6*
Print 5: =0=4*<1<5*<2<3<4=6*
Print 6: =0=4*<5*<1<2<3<4=6*
```

We proceed.

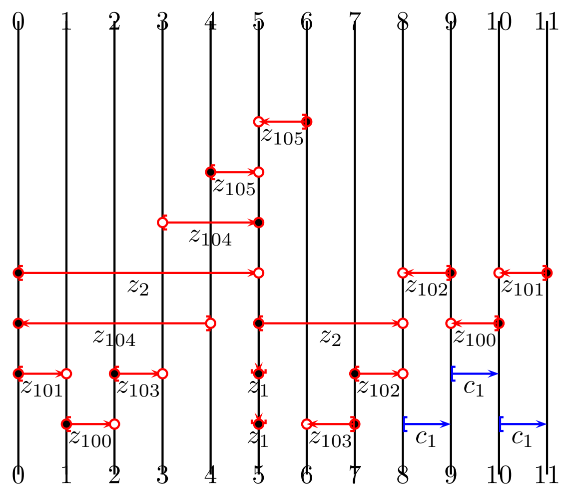
## Generalized Equation root-53.1

We begin from the GE root-53 (see pp. 319). We consider its print

```
Print 1: =0=4*<1<2<3<5*<4=6*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Added (new) boundary 7.
Step 4: Moved (old) base [0-4:z1+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 6: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 6.
Step 7: Moved (old) base [0-1:z101+.] to (new) boundaries 4 - 5.
Step 8: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 7.
Step 9: Moved (old) base [3-4:z104+.] to (new) boundaries 7 - 9.
Step 10: Collapsed (new) base [4-9:z1+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-53.1—is illustrated below:



**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-8:z2+.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [3-5:z104+.] and its dual are of opposite polarity, yet intersect. The base [0-4:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-53.1, as derived from the application of a print to root-53.

## Generalized Equation root-53.2

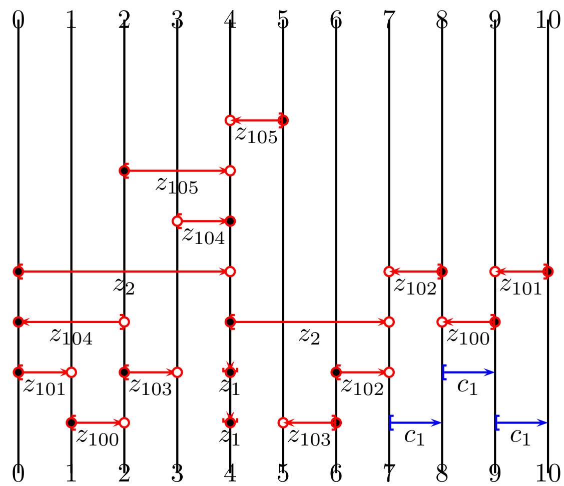
We begin from the GE root-53 (see pp. 319). We consider its print

```
Print 2: =0=4*<1<2=5*<3<4=6*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-4:z1+.] to (new) boundaries 4 - 8.
Step 4: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 8.
Step 5: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 6.
Step 6: Moved (old) base [0-1:z101+.] to (new) boundaries 4 - 5.
Step 7: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 7.
Step 8: Moved (old) base [3-4:z104+.] to (new) boundaries 7 - 8.
Step 9: Collapsed (new) base [4-8:z1+.] to the empty base (8,8).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-53.2—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-7:z2+.] ; Critical Boundary: 4; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 18 valid prints (descendents).

It has 18 legal carrier-to-dual prints, as follows:

```
Print 1: =0=4*<1<2<3<5*<6*<4=7*
Print 2: =0=4*<1<2<5*<3=6*<4=7*
Print 3: =0=4*<1<2<5*<3<6*<4=7*
Print 4: =0=4*<1<2<5*<6*<3<4=7*
Print 5: =0=4*<1=5*<2<3=6*<4=7*
Print 6: =0=4*<1=5*<2<3<6*<4=7*
Print 7: =0=4*<1=5*<2<6*<3<4=7*
Print 8: =0=4*<1=5*<6*<2<3<4=7*
Print 9: =0=4*<1<5*<2<3=6*<4=7*
Print 10: =0=4*<1<5*<2<3<6*<4=7*
Print 11: =0=4*<1<5*<2<6*<3<4=7*
Print 12: =0=4*<1<5*<6*<2<3<4=7*
Print 13: =0=4*<5*<1<2<3=6*<4=7*
Print 14: =0=4*<5*<1<2<3<6*<4=7*
```

```
Print 15: =0=4*<5*<1<2<6*<3<4=7*
Print 16: =0=4*<5*<1=6*<2<3<4=7*
Print 17: =0=4*<5*<1<6*<2<3<4=7*
Print 18: =0=4*<5*<6*<1<2<3<4=7*
```

This completes the consideration of root-53.2, as derived from the application of a print to root-53.

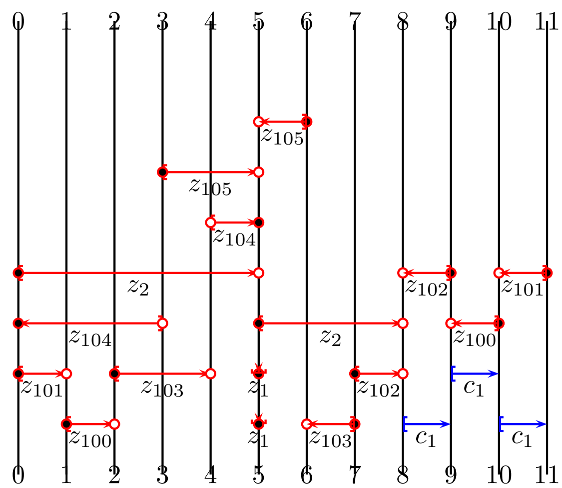
## Generalized Equation root-53.3

We begin from the GE root-53 (see pp. 319). We consider its print

```
Print 3: =0=4*<1<2<5*<3<4=6*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Added (new) boundary 8.
Step 4: Moved (old) base [0-4:z1+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 6: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 6.
Step 7: Moved (old) base [0-1:z101+.] to (new) boundaries 4 - 5.
Step 8: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 8.
Step 9: Moved (old) base [3-4:z104+.] to (new) boundaries 8 - 9.
Step 10: Collapsed (new) base [4-9:z1+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-53.3—is illustrated below:



**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-8:z2+.] ; Critical Boundary: 5; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 34 valid prints (descendents).

It has 34 legal carrier-to-dual prints, as follows:

```
Print 1: =0=5*<1<2<3<4<6*<7*<5=8*
Print 2: =0=5*<1<2<3<6*<4=7*<5=8*
Print 3: =0=5*<1<2<3<6*<4<7*<5=8*
Print 4: =0=5*<1<2<3<6*<7*<4<5=8*
Print 5: =0=5*<1<2=6*<3<4=7*<5=8*
Print 6: =0=5*<1<2=6*<3<4<7*<5=8*
Print 7: =0=5*<1<2=6*<3=7*<4<5=8*
Print 8: =0=5*<1<2=6*<3<7*<4<5=8*
Print 9: =0=5*<1<2=6*<7*<3<4<5=8*
Print 10: =0=5*<1<2<6*<3<4=7*<5=8*
Print 11: =0=5*<1<2<6*<3<4<7*<5=8*
Print 12: =0=5*<1<2<6*<3=7*<4<5=8*
Print 13: =0=5*<1<2<6*<3<7*<4<5=8*
Print 14: =0=5*<1<2<6*<7*<3<4<5=8*
Print 15: =0=5*<1=6*<2<3<4=7*<5=8*
Print 16: =0=5*<1=6*<2<3<4<7*<5=8*
Print 17: =0=5*<1=6*<2<3=7*<4<5=8*
Print 18: =0=5*<1=6*<2<3<7*<4<5=8*
Print 19: =0=5*<1=6*<2<7*<3<4<5=8*
Print 20: =0=5*<1=6*<7*<2<3<4<5=8*
Print 21: =0=5*<1<6*<2<3<4=7*<5=8*
Print 22: =0=5*<1<6*<2<3<4<7*<5=8*
Print 23: =0=5*<1<6*<2<3=7*<4<5=8*
```

```
Print 24: =0=5*<1<6*<2<3<7*<4<5=8*
Print 25: =0=5*<1<6*<2<7*<3<4<5=8*
Print 26: =0=5*<1<6*<7*<2<3<4<5=8*
Print 27: =0=5*<6*<1<2<3<4=7*<5=8*
Print 28: =0=5*<6*<1<2<3<4<7*<5=8*
Print 29: =0=5*<6*<1<2<3=7*<4<5=8*
Print 30: =0=5*<6*<1<2<3<7*<4<5=8*
Print 31: =0=5*<6*<1<2<7*<3<4<5=8*
Print 32: =0=5*<6*<1=7*<2<3<4<5=8*
Print 33: =0=5*<6*<1<7*<2<3<4<5=8*
Print 34: =0=5*<6*<7*<1<2<3<4<5=8*
```

This completes the consideration of root-53.3, as derived from the application of a print to root-53.

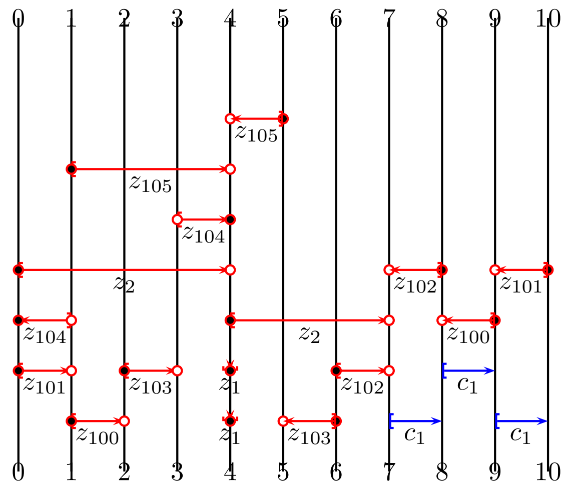
## Generalized Equation root-53.4

We begin from the GE root-53 (see pp. 319). We consider its print

```
Print 4: =0=4*<1=5*<2<3<4=6*
```

**Sequence of actions in performing the Print 4:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-4:z1+.] to (new) boundaries 4 - 8.
Step 4: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 8.
Step 5: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 6.
Step 6: Moved (old) base [0-1:z101+.] to (new) boundaries 4 - 5.
Step 7: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 7.
Step 8: Moved (old) base [3-4:z104+.] to (new) boundaries 7 - 8.
Step 9: Collapsed (new) base [4-8:z1+.] to the empty base (8,8).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-53.4—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-7:z2+.] ; Critical Boundary: 4; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 17 valid prints (descendents).

It has 17 legal carrier-to-dual prints, as follows:

```
Print 1: =0=4*<1<2<3<5*<6*<4=7*
Print 2: =0=4*<1<2=5*<3=6*<4=7*
Print 3: =0=4*<1<2=5*<3<6*<4=7*
Print 4: =0=4*<1<2=5*<6*<3<4=7*
Print 5: =0=4*<1<2<5*<3=6*<4=7*
Print 6: =0=4*<1<2<5*<3<6*<4=7*
Print 7: =0=4*<1<2<5*<6*<3<4=7*
Print 8: =0=4*<1<5*<2<3=6*<4=7*
Print 9: =0=4*<1<5*<2<3<6*<4=7*
Print 10: =0=4*<1<5*<2<6*<3<4=7*
Print 11: =0=4*<1<5*<6*<2<3<4=7*
Print 12: =0=4*<5*<1<2<3=6*<4=7*
Print 13: =0=4*<5*<1<2<3<6*<4=7*
Print 14: =0=4*<5*<1<2<6*<3<4=7*
Print 15: =0=4*<5*<1=6*<2<3<4=7*
Print 16: =0=4*<5*<1<6*<2<3<4=7*
Print 17: =0=4*<5*<6*<1<2<3<4=7*
```

This completes the consideration of root-53.4, as derived from the application of a print to root-53.

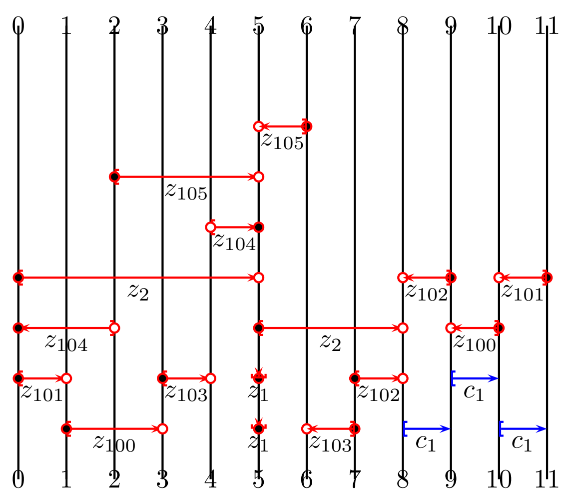
## Generalized Equation root-53.5

We begin from the GE root-53 (see pp. 319). We consider its print

```
Print 5: =0=4*<1<5*<2<3<4=6*
```

**Sequence of actions in performing the Print 5:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 7.
Step 3: Added (new) boundary 8.
Step 4: Moved (old) base [0-4:z1+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 6: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 7.
Step 7: Moved (old) base [0-1:z101+.] to (new) boundaries 4 - 5.
Step 8: Moved (old) base [2-3:z103+.] to (new) boundaries 7 - 8.
Step 9: Moved (old) base [3-4:z104+.] to (new) boundaries 8 - 9.
Step 10: Collapsed (new) base [4-9:z1+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-53.5—is illustrated below:




**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-8:z2+.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [9-10:z100-.]

has constraints with its dual that stretch the constant segment 9 - 10 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-53.5, as derived from the application of a print to root-53.

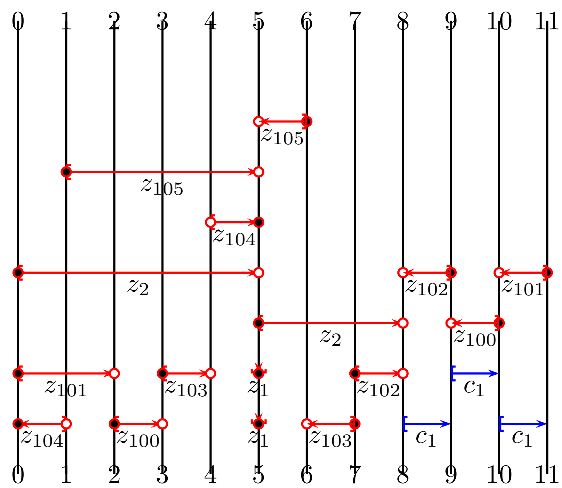
## Generalized Equation root-53.6

We begin from the GE root-53 (see pp. 319). We consider its print

```
Print 6: =0=4*<5*<1<2<3<4=6*
```

**Sequence of actions in performing the Print 6:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 7.
Step 3: Added (new) boundary 8.
Step 4: Moved (old) base [0-4:z1+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 6: Moved (old) base [1-2:z100+.] to (new) boundaries 6 - 7.
Step 7: Moved (old) base [0-1:z101+.] to (new) boundaries 4 - 6.
Step 8: Moved (old) base [2-3:z103+.] to (new) boundaries 7 - 8.
Step 9: Moved (old) base [3-4:z104+.] to (new) boundaries 8 - 9.
Step 10: Collapsed (new) base [4-9:z1+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-53.6—is illustrated below:




**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-8:z2+.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [10-11:z101-.] has constraints with its dual that stretch the constant segment 10 - 11 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-53.6, as derived from the application of a print to root-53.

## Generalized Equation root-53.2.1

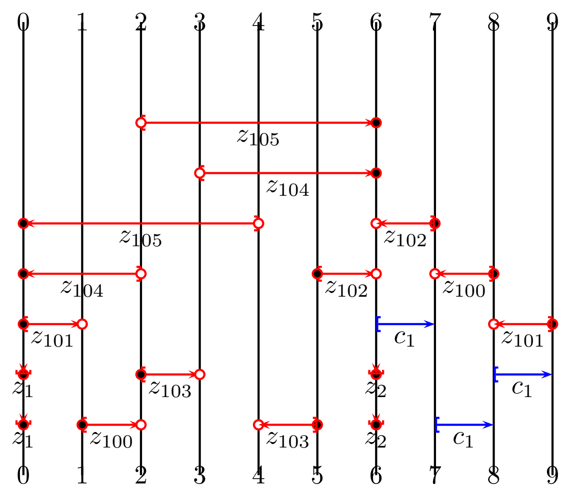
We begin from the GE root-53.2 (see pp. 321). We consider its print

```
Print 1: =0=4*<1<2<3<5*<6*<4=7*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Added (new) boundary 7.
Step 4: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 10.
Step 5: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 6.
Step 6: Moved (old) base [0-1:z101+.] to (new) boundaries 4 - 5.
Step 7: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 7.
Step 8: Moved (old) base [3-4:z104+.] to (new) boundaries 7 - 10.
Step 9: Moved (old) base [0-2:z104-.] to (new) boundaries 4 - 6.
Step 10: Moved (old) base [2-4:z105+.] to (new) boundaries 6 - 10.
Step 11: Collapsed (new) base [4-10:z2+.] to the empty base (10,10).

Step 12: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 15: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-53.2.1—is illustrated below:




**GE Information**: Carrier: [0-4:z105-.] ; Carrier Dual: [2-6:z105+.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [2-6:z105+.] and its dual are of opposite polarity, yet intersect. The base [0-4:z105-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-53.2.1, as derived from the application of a print to root-53.2.

## Generalized Equation root-53.2.2

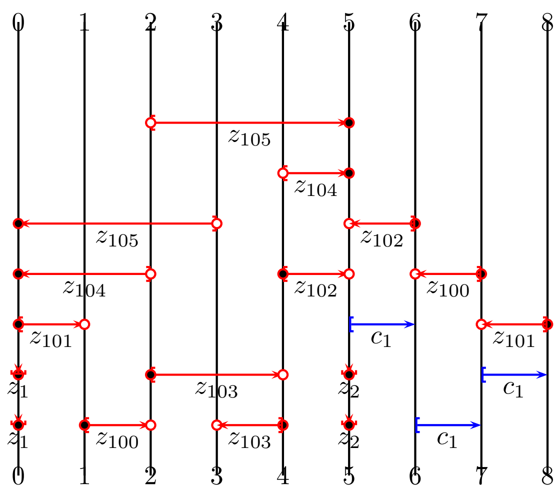
We begin from the GE root-53.2 (see pp. 321). We consider its print

```
Print 2: =0=4*<1<2<5*<3=6*<4=7*
```

**Sequence of actions in performing the Print 2:**
Step 1: Added (new) boundary 5.

Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 4: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 6.
Step 5: Moved (old) base [0-1:z101+.] to (new) boundaries 4 - 5.
Step 6: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 8.
Step 7: Moved (old) base [3-4:z104+.] to (new) boundaries 8 - 9.
Step 8: Moved (old) base [0-2:z104-.] to (new) boundaries 4 - 6.
Step 9: Moved (old) base [2-4:z105+.] to (new) boundaries 6 - 9.
Step 10: Collapsed (new) base [4-9:z2+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-53.2.2—is illustrated below:




**GE Information**: Carrier: [0-3:z105-.] ; Carrier Dual: [2-5:z105+.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [2-4:z103+.] and its dual are of opposite polarity, yet intersect. The base [3-4:z103-.] and its dual are of opposite polarity, yet intersect. The base [2-5:z105+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z105-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-53.2.2, as derived from the application of a print to root-53.2.

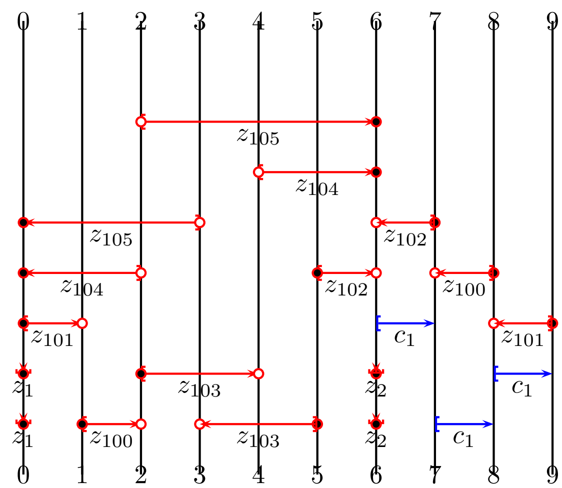
## Generalized Equation root-53.2.3

We begin from the GE root-53.2 (see pp. 321). We consider its print

```
Print 3: =0=4*<1<2<5*<3<6*<4=7*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Added (new) boundary 8.
Step 4: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 10.
Step 5: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 6.
Step 6: Moved (old) base [0-1:z101+.] to (new) boundaries 4 - 5.
Step 7: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 8.
Step 8: Moved (old) base [3-4:z104+.] to (new) boundaries 8 - 10.
Step 9: Moved (old) base [0-2:z104-.] to (new) boundaries 4 - 6.
Step 10: Moved (old) base [2-4:z105+.] to (new) boundaries 6 - 10.
Step 11: Collapsed (new) base [4-10:z2+.] to the empty base (10,10).
Step 12: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 15: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-53.2.3—is illustrated below:




**GE Information**: Carrier: [0-3:z105-.] ; Carrier Dual: [2-6:z105+.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [2-4:z103+.] and its dual are of opposite polarity, yet intersect. The base [3-5:z103-.] and its dual are of opposite polarity, yet intersect. The base [2-6:z105+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z105-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-53.2.3, as derived from the application of a print to root-53.2.

## Generalized Equation root-53.2.4

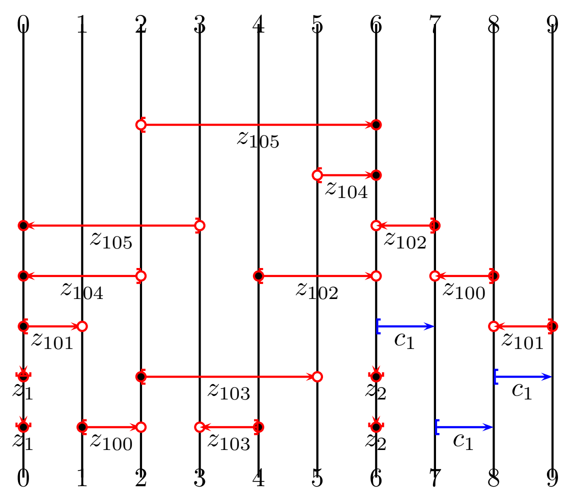
We begin from the GE root-53.2 (see pp. 321). We consider its print

```
Print 4: =0=4*<1<2<5*<6*<3<4=7*
```

**Sequence of actions in performing the Print 4:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Added (new) boundary 9.
Step 4: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 10.
Step 5: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 6.
Step 6: Moved (old) base [0-1:z101+.] to (new) boundaries 4 - 5.
Step 7: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 9.
Step 8: Moved (old) base [3-4:z104+.] to (new) boundaries 9 - 10.
Step 9: Moved (old) base [0-2:z104-.] to (new) boundaries 4 - 6.

Step 10: Moved (old) base [2-4:z105+.] to (new) boundaries 6 - 10.
Step 11: Collapsed (new) base [4-10:z2+.] to the empty base (10,10).
Step 12: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 15: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-53.2.4—is illustrated below:



**GE Information**: Carrier: [0-3:z105-.] ; Carrier Dual: [2-6:z105+.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [2-5:z103+.] and its dual are of opposite polarity, yet intersect. The base [3-4:z103-.] and its dual are of opposite polarity, yet intersect. The base [2-6:z105+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z105-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-53.2.4, as derived from the application of a print to root-53.2.

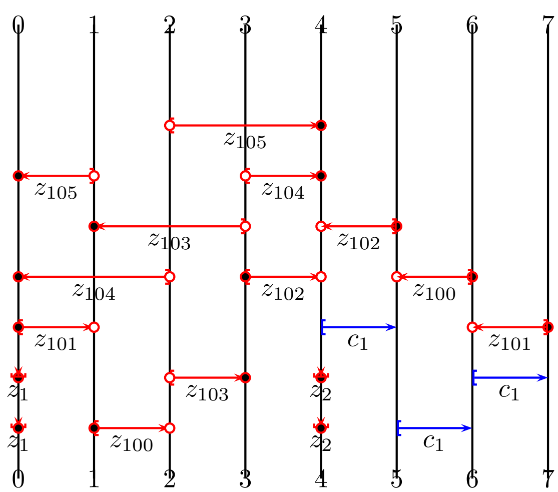
## Generalized Equation root-53.2.5

We begin from the GE root-53.2 (see pp. 321). We consider its print

```
Print 5: =0=4*<1=5*<2<3=6*<4=7*
```

**Sequence of actions in performing the Print 5:**
Step 1: Added (new) boundary 6.
Step 2: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 8.
Step 3: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 6.
Step 4: Moved (old) base [0-1:z101+.] to (new) boundaries 4 - 5.
Step 5: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 7.
Step 6: Moved (old) base [3-4:z104+.] to (new) boundaries 7 - 8.
Step 7: Moved (old) base [0-2:z104-.] to (new) boundaries 4 - 6.
Step 8: Moved (old) base [2-4:z105+.] to (new) boundaries 6 - 8.
Step 9: Collapsed (new) base [4-8:z2+.] to the empty base (8,8).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-53.2.5—is illustrated below:




**GE Information**: Carrier: [0-2:z104-.] ; Carrier Dual: [3-4:z104+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [2-3:z103+.] and its dual are of opposite polarity, yet intersect. The base [1-3:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-53.2.5, as derived from the application of a print to root-53.2.

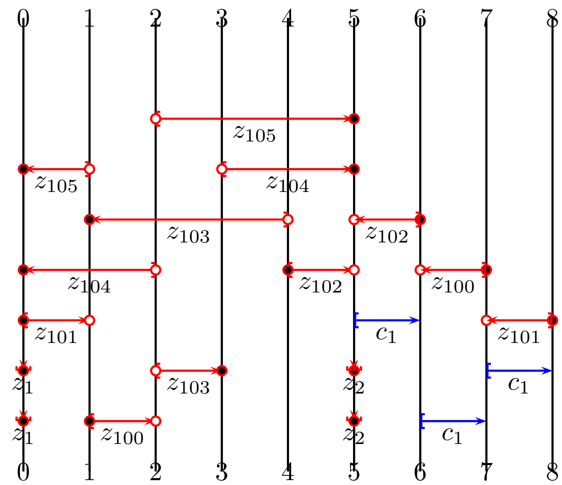
## Generalized Equation root-53.2.6

We begin from the GE root-53.2 (see pp. 321). We consider its print

```
Print 6: =0=4*<1=5*<2<3<6*<4=7*
```

**Sequence of actions in performing the Print 6:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 4: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 6.
Step 5: Moved (old) base [0-1:z101+.] to (new) boundaries 4 - 5.
Step 6: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 7.
Step 7: Moved (old) base [3-4:z104+.] to (new) boundaries 7 - 9.
Step 8: Moved (old) base [0-2:z104-.] to (new) boundaries 4 - 6.
Step 9: Moved (old) base [2-4:z105+.] to (new) boundaries 6 - 9.
Step 10: Collapsed (new) base [4-9:z2+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-53.2.6—is illustrated below:




**GE Information**: Carrier: [0-2:z104-.] ; Carrier Dual: [3-5:z104+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [2-3:z103+.] and its dual are of opposite polarity, yet intersect. The base [1-4:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-53.2.6, as derived from the application of a print to root-53.2.

## Generalized Equation root-53.2.7

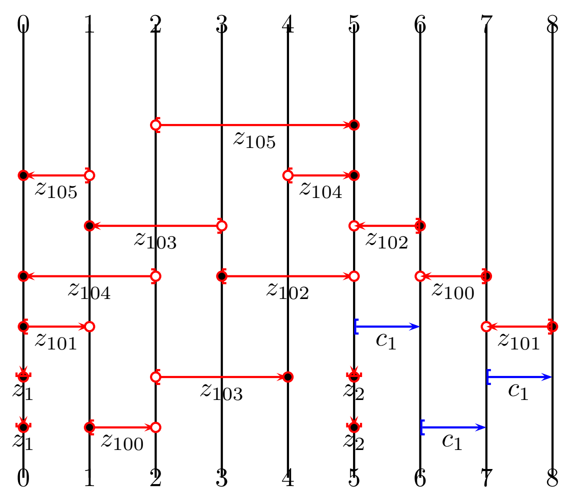
We begin from the GE root-53.2 (see pp. 321). We consider its print

```
Print 7: =0=4*<1=5*<2<6*<3<4=7*
```

**Sequence of actions in performing the Print 7:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 8.
Step 3: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 4: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 6.
Step 5: Moved (old) base [0-1:z101+.] to (new) boundaries 4 - 5.
Step 6: Moved (old) base [2-3:z103+.] to (new) boundaries 6 - 8.
Step 7: Moved (old) base [3-4:z104+.] to (new) boundaries 8 - 9.
Step 8: Moved (old) base [0-2:z104-.] to (new) boundaries 4 - 6.
Step 9: Moved (old) base [2-4:z105+.] to (new) boundaries 6 - 9.
Step 10: Collapsed (new) base [4-9:z2+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This

will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-53.2.7—is illustrated below:




**GE Information**: Carrier: [0-2:z104-.] ; Carrier Dual: [4-5:z104+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [2-4:z103+.] and its dual are of opposite polarity, yet intersect. The base [1-3:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-53.2.7, as derived from the application of a print to root-53.2.

## Generalized Equation root-53.2.8

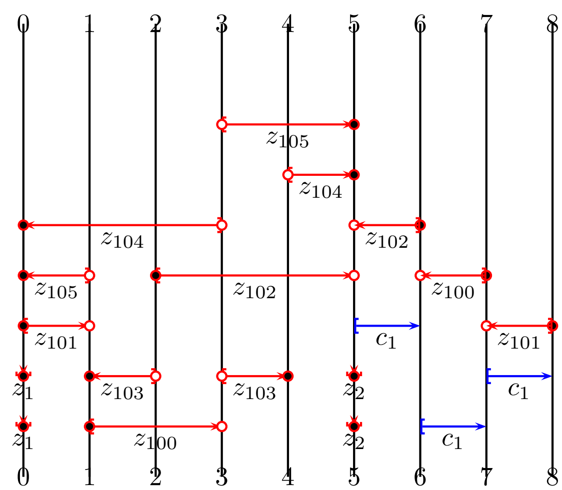
We begin from the GE root-53.2 (see pp. 321). We consider its print

```
Print 8: =0=4*<1=5*<6*<2<3<4=7*
```

**Sequence of actions in performing the Print 8:**
Step 1: Added (new) boundary 7.

Step 2: Added (new) boundary 8.
Step 3: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 4: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 7.
Step 5: Moved (old) base [0-1:z101+.] to (new) boundaries 4 - 5.
Step 6: Moved (old) base [2-3:z103+.] to (new) boundaries 7 - 8.
Step 7: Moved (old) base [3-4:z104+.] to (new) boundaries 8 - 9.
Step 8: Moved (old) base [0-2:z104-.] to (new) boundaries 4 - 7.
Step 9: Moved (old) base [2-4:z105+.] to (new) boundaries 7 - 9.
Step 10: Collapsed (new) base [4-9:z2+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-53.2.8—is illustrated below:




**GE Information**: Carrier: [0-3:z104-.] ; Carrier Dual: [4-5:z104+.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [5-6:z102-.] has constraints with its dual that stretch the constant segment 5 - 6 to length different from 1. The base [6-7:z100-.] has constraints with its dual that stretch the constant segment 6 - 7 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-53.2.8, as derived from the application

of a print to root-53.2.

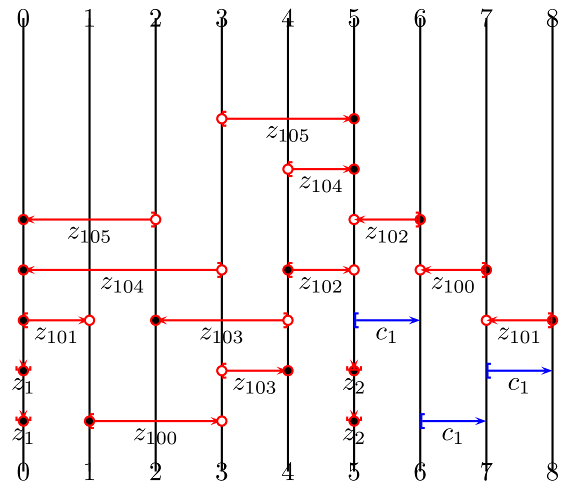
## Generalized Equation root-53.2.9

We begin from the GE root-53.2 (see pp. 321). We consider its print

```
Print 9: =0=4*<1<5*<2<3=6*<4=7*
```

**Sequence of actions in performing the Print 9:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-4:z2+.] to (new) boundaries 4 - 9.
Step 4: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 7.
Step 5: Moved (old) base [0-1:z101+.] to (new) boundaries 4 - 5.
Step 6: Moved (old) base [2-3:z103+.] to (new) boundaries 7 - 8.
Step 7: Moved (old) base [3-4:z104+.] to (new) boundaries 8 - 9.
Step 8: Moved (old) base [0-2:z104-.] to (new) boundaries 4 - 7.
Step 9: Moved (old) base [2-4:z105+.] to (new) boundaries 7 - 9.
Step 10: Collapsed (new) base [4-9:z2+.] to the empty base (9,9).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 14: Deleted (new) boundary 3 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

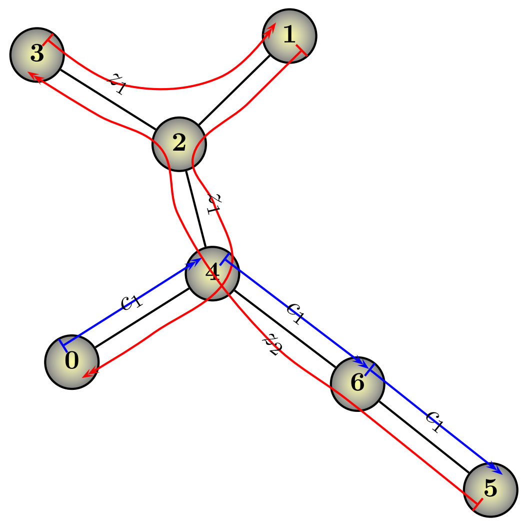
Upon applying the print, the GE we obtain—which we refer to as root-53.2.9—is illustrated below:




**GE Information**: Carrier: [0-3:z104-.] ; Carrier Dual: [4-5:z104+.] ; Critical Boundary: 2; Observe the following facts about this GE: The base [3-4:z103+.] and its dual are of opposite polarity, yet intersect. The base [2-4:z103-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-53.2.9, as derived from the application of a print to root-53.2.

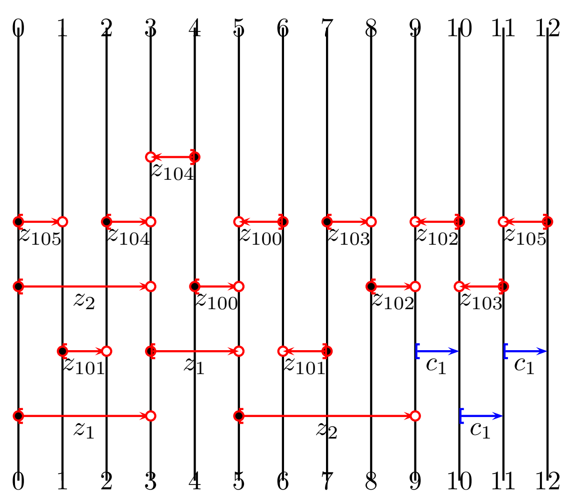
# 54 Cancellation scheme #54




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 4 \leftarrow 0$ |
| $z_1$ | $3 \leftarrow 2 \leftarrow 1$ |
| $z_2$ | $5 \leftarrow 6 \leftarrow 4 \leftarrow 2 \leftarrow 3$ |
| $c_1$ | $6 \leftarrow 5$ |
| $c_1$ | $4 \leftarrow 6$ |
| $c_1$ | $0 \leftarrow 4$ |

## Generalized Equation root-54

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-3:z1+.] ; Carrier Dual: [3-5:z1+.] ; Critical Boundary: 3; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 4 valid prints (descendents).

It has 4 legal carrier-to-dual prints, as follows:

```
Print 1: =0=3*<1<2<4*<3=5*
Print 2: =0=3*<1=4*<2<3=5*
Print 3: =0=3*<1<4*<2<3=5*
Print 4: =0=3*<4*<1<2<3=5*
```

We proceed.

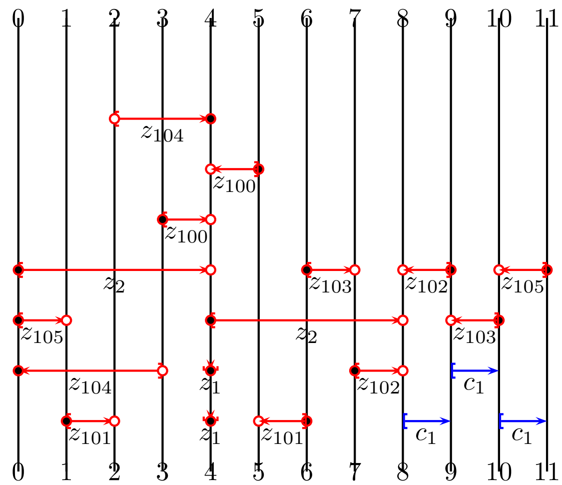
## Generalized Equation root-54.1

We begin from the GE root-54 (see pp. 342). We consider its print

```
Print 1: =0=3*<1<2<4*<3=5*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 5.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 5: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 5.
Step 6: Moved (old) base [2-3:z104+.] to (new) boundaries 5 - 7.
Step 7: Moved (old) base [0-1:z105+.] to (new) boundaries 3 - 4.
Step 8: Collapsed (new) base [3-7:z1+.] to the empty base (7,7).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-54.1—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-8:z2+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [2-4:z104+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z104-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-54.1, as derived from the application of a print to root-54.

## Generalized Equation root-54.2

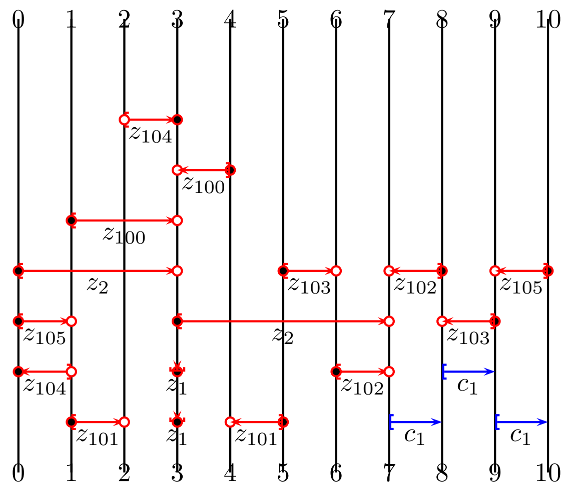
We begin from the GE root-54 (see pp. 342). We consider its print

```
Print 2: =0=3*<1=4*<2<3=5*
```

**Sequence of actions in performing the Print 2:**
<u>Step 1</u>: Added (new) boundary 5.
<u>Step 2</u>: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 6.
<u>Step 3</u>: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 6.
<u>Step 4</u>: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 5.
<u>Step 5</u>: Moved (old) base [2-3:z104+.] to (new) boundaries 5 - 6.
<u>Step 6</u>: Moved (old) base [0-1:z105+.] to (new) boundaries 3 - 4.
<u>Step 7</u>: Collapsed (new) base [3-6:z1+.] to the empty base (6,6).
<u>Step 8</u>: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
<u>Step 9</u>: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-54.2—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-7:z2+.] ; Critical Boundary: 3; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 16 valid prints (descendents).

It has 16 legal carrier-to-dual prints, as follows:

```
Print 1: =0=3*<1<2<4*<5*<6*<3=7*
Print 2: =0=3*<1<4*<2=5*<6*<3=7*
Print 3: =0=3*<1<4*<2<5*<6*<3=7*
Print 4: =0=3*<1<4*<5*<2=6*<3=7*
Print 5: =0=3*<1<4*<5*<2<6*<3=7*
Print 6: =0=3*<1<4*<5*<6*<2<3=7*
Print 7: =0=3*<4*<1<2=5*<6*<3=7*
Print 8: =0=3*<4*<1<2<5*<6*<3=7*
Print 9: =0=3*<4*<1<5*<2=6*<3=7*
Print 10: =0=3*<4*<1<5*<2<6*<3=7*
Print 11: =0=3*<4*<1<5*<6*<2<3=7*
Print 12: =0=3*<4*<5*<1<2=6*<3=7*
Print 13: =0=3*<4*<5*<1<2<6*<3=7*
Print 14: =0=3*<4*<5*<1=6*<2<3=7*
Print 15: =0=3*<4*<5*<1<6*<2<3=7*
Print 16: =0=3*<4*<5*<6*<1<2<3=7*
```

This completes the consideration of root-54.2, as derived from the application of a print to root-54.

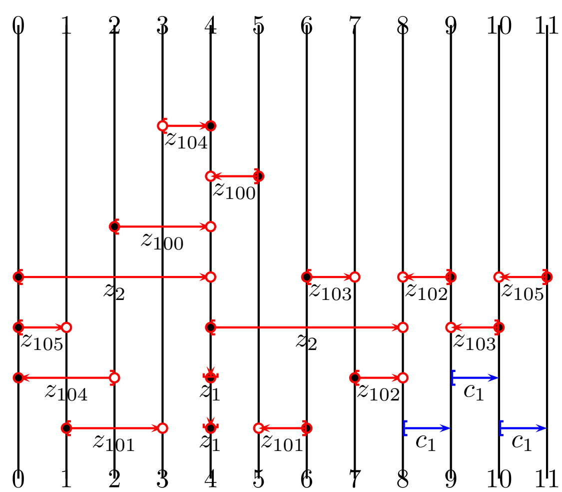
## Generalized Equation root-54.3

We begin from the GE root-54 (see pp. 342). We consider its print

```
Print 3: =0=3*<1<4*<2<3=5*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 5: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 6.
Step 6: Moved (old) base [2-3:z104+.] to (new) boundaries 6 - 7.
Step 7: Moved (old) base [0-1:z105+.] to (new) boundaries 3 - 4.
Step 8: Collapsed (new) base [3-7:z1+.] to the empty base (7,7).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-54.3—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-8:z2+.] ; Critical Boundary: 4; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 52 valid prints (descendents).

It has 52 legal carrier-to-dual prints, as follows:

```
Print 1: =0=4*<1<2<3<5*<6*<7*<4=8*
Print 2: =0=4*<1<2<5*<3=6*<7*<4=8*
Print 3: =0=4*<1<2<5*<3<6*<7*<4=8*
Print 4: =0=4*<1<2<5*<6*<3=7*<4=8*
Print 5: =0=4*<1<2<5*<6*<3<7*<4=8*
Print 6: =0=4*<1<2<5*<6*<7*<3<4=8*
Print 7: =0=4*<1=5*<2<3=6*<7*<4=8*
Print 8: =0=4*<1=5*<2<3<6*<7*<4=8*
Print 9: =0=4*<1=5*<2=6*<3=7*<4=8*
Print 10: =0=4*<1=5*<2=6*<3<7*<4=8*
Print 11: =0=4*<1=5*<2=6*<7*<3<4=8*
Print 12: =0=4*<1=5*<2<6*<3=7*<4=8*
Print 13: =0=4*<1=5*<2<6*<3<7*<4=8*
Print 14: =0=4*<1=5*<2<6*<7*<3<4=8*
Print 15: =0=4*<1=5*<6*<2<3=7*<4=8*
Print 16: =0=4*<1=5*<6*<2<3<7*<4=8*
Print 17: =0=4*<1=5*<6*<2=7*<3<4=8*
Print 18: =0=4*<1=5*<6*<2<7*<3<4=8*
Print 19: =0=4*<1=5*<6*<7*<2<3<4=8*
Print 20: =0=4*<1<5*<2<3=6*<7*<4=8*
Print 21: =0=4*<1<5*<2<3<6*<7*<4=8*
Print 22: =0=4*<1<5*<2=6*<3=7*<4=8*
Print 23: =0=4*<1<5*<2=6*<3<7*<4=8*
Print 24: =0=4*<1<5*<2=6*<7*<3<4=8*
Print 25: =0=4*<1<5*<2<6*<3=7*<4=8*
Print 26: =0=4*<1<5*<2<6*<3<7*<4=8*
Print 27: =0=4*<1<5*<2<6*<7*<3<4=8*
Print 28: =0=4*<1<5*<6*<2<3=7*<4=8*
Print 29: =0=4*<1<5*<6*<2<3<7*<4=8*
Print 30: =0=4*<1<5*<6*<2=7*<3<4=8*
Print 31: =0=4*<1<5*<6*<2<7*<3<4=8*
Print 32: =0=4*<1<5*<6*<7*<2<3<4=8*
Print 33: =0=4*<5*<1<2<3=6*<7*<4=8*
Print 34: =0=4*<5*<1<2<3<6*<7*<4=8*
Print 35: =0=4*<5*<1<2=6*<3=7*<4=8*
Print 36: =0=4*<5*<1<2=6*<3<7*<4=8*
Print 37: =0=4*<5*<1<2=6*<7*<3<4=8*
Print 38: =0=4*<5*<1<2<6*<3=7*<4=8*
Print 39: =0=4*<5*<1<2<6*<3<7*<4=8*
Print 40: =0=4*<5*<1<2<6*<7*<3<4=8*
Print 41: =0=4*<5*<1<6*<2<3=7*<4=8*
Print 42: =0=4*<5*<1<6*<2<3<7*<4=8*
Print 43: =0=4*<5*<1<6*<2=7*<3<4=8*
Print 44: =0=4*<5*<1<6*<2<7*<3<4=8*
```

```
Print 45: =0=4*<5*<1<6*<7*<2<3<4=8*
Print 46: =0=4*<5*<6*<1<2<3=7*<4=8*
Print 47: =0=4*<5*<6*<1<2<3<7*<4=8*
Print 48: =0=4*<5*<6*<1<2=7*<3<4=8*
Print 49: =0=4*<5*<6*<1<2<7*<3<4=8*
Print 50: =0=4*<5*<6*<1=7*<2<3<4=8*
Print 51: =0=4*<5*<6*<1<7*<2<3<4=8*
Print 52: =0=4*<5*<6*<7*<1<2<3<4=8*
```

This completes the consideration of root-54.3, as derived from the application of a print to root-54.

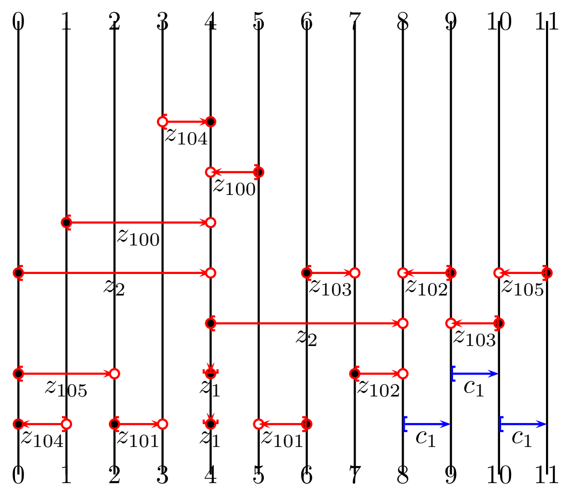
## Generalized Equation root-54.4

We begin from the GE root-54 (see pp. 342). We consider its print

```
Print 4: =0=3*<4*<1<2<3=5*
```

**Sequence of actions in performing the Print 4:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 5: Moved (old) base [1-2:z101+.] to (new) boundaries 5 - 6.
Step 6: Moved (old) base [2-3:z104+.] to (new) boundaries 6 - 7.
Step 7: Moved (old) base [0-1:z105+.] to (new) boundaries 3 - 5.
Step 8: Collapsed (new) base [3-7:z1+.] to the empty base (7,7).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-54.4—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-8:z2+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [10-11:z105-.] has constraints with its dual that stretch the constant segment 10 - 11 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-54.4, as derived from the application of a print to root-54.

## Generalized Equation root-54.2.1

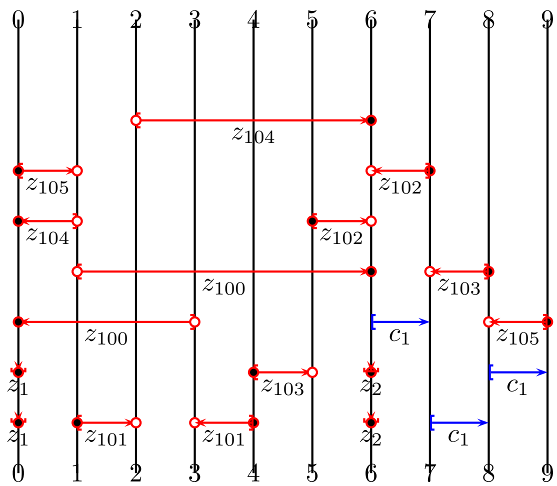
We begin from the GE root-54.2 (see pp. 344). We consider its print

```
Print 1: =0=3*<1<2<4*<5*<6*<3=7*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 5.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 9.
Step 4: Moved (old) base [1-3:z100+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 5.
Step 6: Moved (old) base [2-3:z104+.] to (new) boundaries 5 - 9.
Step 7: Moved (old) base [0-1:z104-.] to (new) boundaries 3 - 4.
Step 8: Moved (old) base [0-1:z105+.] to (new) boundaries 3 - 4.
Step 9: Collapsed (new) base [3-9:z2+.] to the empty base (9,9).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

<u>Step 11</u>: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
<u>Step 12</u>: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-54.2.1—is illustrated below:




**GE Information**: Carrier: [0-3:z100-.] ; Carrier Dual: [1-6:z100+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-6:z100+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z100-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-54.2.1, as derived from the application of a print to root-54.2.

## Generalized Equation root-54.2.2

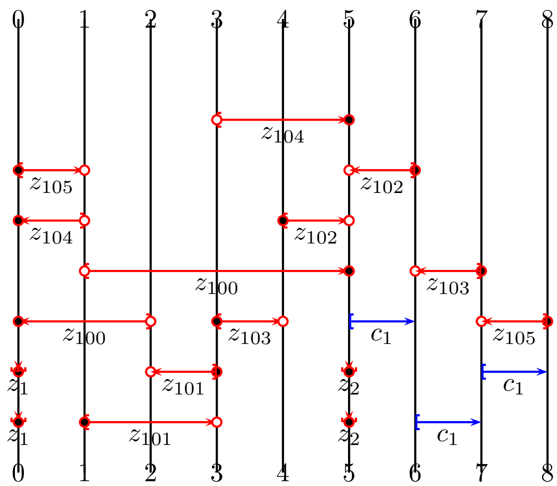
We begin from the GE root-54.2 (see pp. 344). We consider its print

```
Print 2: =0=3*<1<4*<2=5*<6*<3=7*
```

**Sequence of actions in performing the Print 2:**
<u>Step 1</u>: Added (new) boundary 4.
<u>Step 2</u>: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
<u>Step 3</u>: Moved (old) base [1-3:z100+.] to (new) boundaries 4 - 8.
<u>Step 4</u>: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 6.

Step 5: Moved (old) base [2-3:z104+.] to (new) boundaries 6 - 8.
Step 6: Moved (old) base [0-1:z104-.] to (new) boundaries 3 - 4.
Step 7: Moved (old) base [0-1:z105+.] to (new) boundaries 3 - 4.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-54.2.2—is illustrated below:




**GE Information**: Carrier: [0-2:z100-.] ; Carrier Dual: [1-5:z100+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-5:z100+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z100-.] and its dual are of opposite polarity, yet intersect. The base [1-3:z101+.] and its dual are of opposite polarity, yet intersect. The base [2-3:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-54.2.2, as derived from the application of a print to root-54.2.

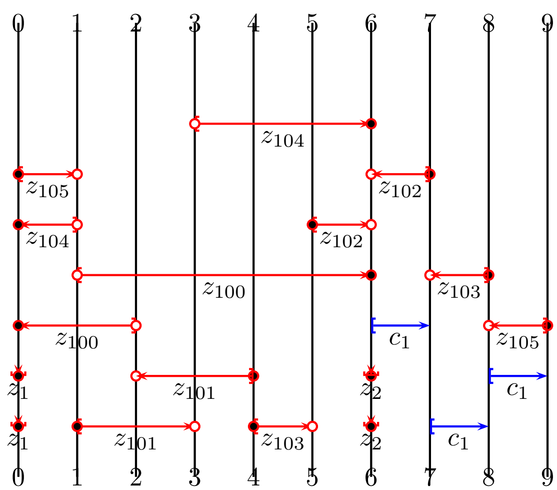
## Generalized Equation root-54.2.3

We begin from the GE root-54.2 (see pp. 344). We consider its print

`Print 3: =0=3*<1<4*<2<5*<6*<3=7*`

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 9.
Step 4: Moved (old) base [1-3:z100+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 6.
Step 6: Moved (old) base [2-3:z104+.] to (new) boundaries 6 - 9.
Step 7: Moved (old) base [0-1:z104-.] to (new) boundaries 3 - 4.
Step 8: Moved (old) base [0-1:z105+.] to (new) boundaries 3 - 4.
Step 9: Collapsed (new) base [3-9:z2+.] to the empty base (9,9).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-54.2.3—is illustrated below:




**GE Information**: Carrier: [0-2:z100-.] ; Carrier Dual: [1-6:z100+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-6:z100+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z100-.] and its dual are of opposite polarity, yet intersect. The base [1-3:z101+.] and its dual are of opposite polarity, yet intersect. The base [2-4:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-54.2.3, as derived from the application of a print to root-54.2.

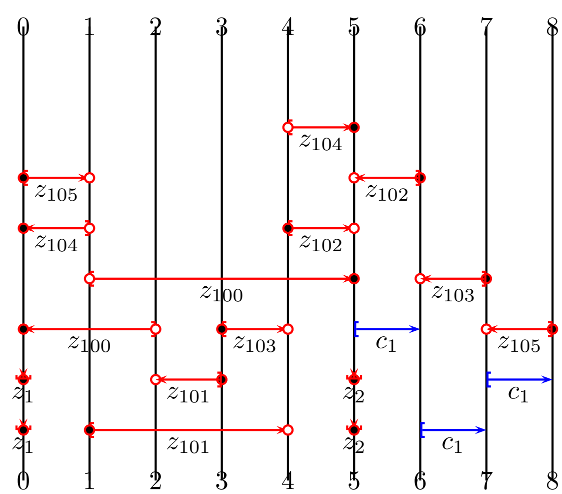
## Generalized Equation root-54.2.4

We begin from the GE root-54.2 (see pp. 344). We consider its print

```
Print 4: =0=3*<1<4*<5*<2=6*<3=7*
```

**Sequence of actions in performing the Print 4:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 3: Moved (old) base [1-3:z100+.] to (new) boundaries 4 - 8.
Step 4: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 7.
Step 5: Moved (old) base [2-3:z104+.] to (new) boundaries 7 - 8.
Step 6: Moved (old) base [0-1:z104-.] to (new) boundaries 3 - 4.
Step 7: Moved (old) base [0-1:z105+.] to (new) boundaries 3 - 4.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-54.2.4—is illustrated below:



**GE Information**: Carrier: [0-2:z100-.] ; Carrier Dual: [1-5:z100+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-5:z100+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z100-.] and its dual are of opposite polarity, yet intersect. The base [1-4:z101+.] and its dual are of opposite polarity, yet intersect. The base [2-3:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-54.2.4, as derived from the application of a print to root-54.2.

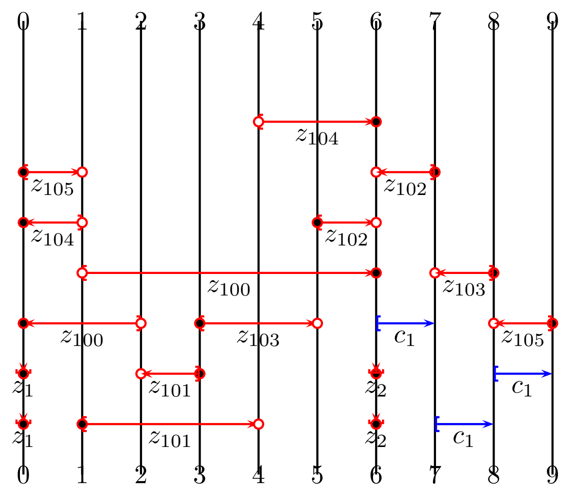
## Generalized Equation root-54.2.5

We begin from the GE root-54.2 (see pp. 344). We consider its print

```
Print 5: =0=3*<1<4*<5*<2<6*<3=7*
```

**Sequence of actions in performing the Print 5:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 9.
Step 4: Moved (old) base [1-3:z100+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 7.
Step 6: Moved (old) base [2-3:z104+.] to (new) boundaries 7 - 9.
Step 7: Moved (old) base [0-1:z104-.] to (new) boundaries 3 - 4.
Step 8: Moved (old) base [0-1:z105+.] to (new) boundaries 3 - 4.
Step 9: Collapsed (new) base [3-9:z2+.] to the empty base (9,9).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-54.2.5—is illustrated below:




**GE Information**: Carrier: [0-2:z100-.] ; Carrier Dual: [1-6:z100+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-6:z100+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z100-.] and its dual are of opposite polarity, yet intersect. The base [1-4:z101+.] and its dual are of opposite polarity, yet intersect. The base [2-3:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-54.2.5, as derived from the application of a print to root-54.2.

## Generalized Equation root-54.2.6

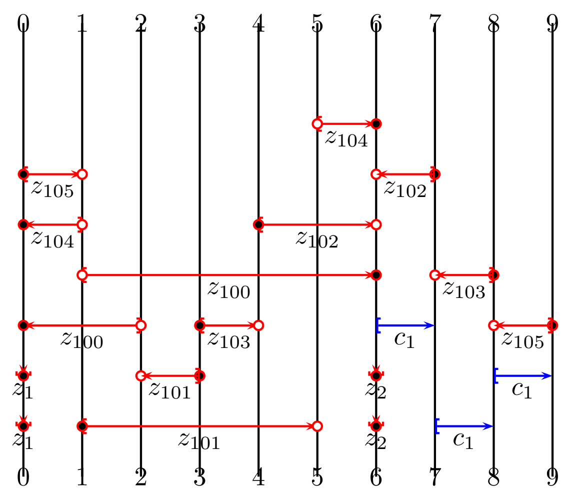
We begin from the GE root-54.2 (see pp. 344). We consider its print

```
Print 6: =0=3*<1<4*<5*<6*<2<3=7*
```

**Sequence of actions in performing the Print 6:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 8.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 9.
Step 4: Moved (old) base [1-3:z100+.] to (new) boundaries 4 - 9.
Step 5: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 8.
Step 6: Moved (old) base [2-3:z104+.] to (new) boundaries 8 - 9.
Step 7: Moved (old) base [0-1:z104-.] to (new) boundaries 3 - 4.
Step 8: Moved (old) base [0-1:z105+.] to (new) boundaries 3 - 4.
Step 9: Collapsed (new) base [3-9:z2+.] to the empty base (9,9).

Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-54.2.6—is illustrated below:




**GE Information**: Carrier: [0-2:z100-.] ; Carrier Dual: [1-6:z100+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [1-6:z100+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z100-.] and its dual are of opposite polarity, yet intersect. The base [1-5:z101+.] and its dual are of opposite polarity, yet intersect. The base [2-3:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-54.2.6, as derived from the application of a print to root-54.2.

## Generalized Equation root-54.2.7

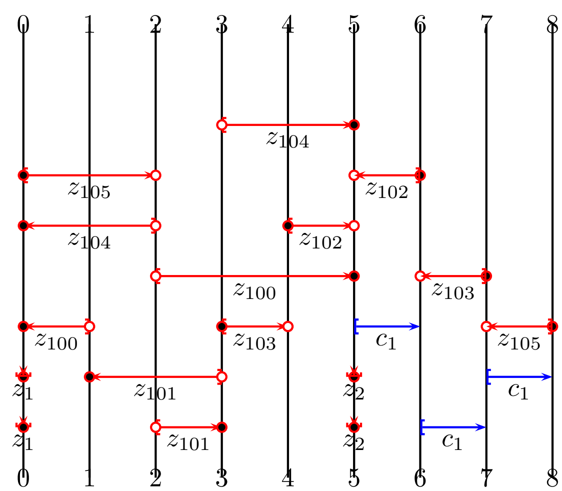
We begin from the GE root-54.2 (see pp. 344). We consider its print

```
Print 7: =0=3*<4*<1<2=5*<6*<3=7*
```

**Sequence of actions in performing the Print 7:**
Step 1: Added (new) boundary 5.

Step 2: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 3: Moved (old) base [1-3:z100+.] to (new) boundaries 5 - 8.
Step 4: Moved (old) base [1-2:z101+.] to (new) boundaries 5 - 6.
Step 5: Moved (old) base [2-3:z104+.] to (new) boundaries 6 - 8.
Step 6: Moved (old) base [0-1:z104-.] to (new) boundaries 3 - 5.
Step 7: Moved (old) base [0-1:z105+.] to (new) boundaries 3 - 5.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-54.2.7—is illustrated below:




**GE Information**: Carrier: [0-2:z104-.] ; Carrier Dual: [3-5:z104+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [2-3:z101+.] and its dual are of opposite polarity, yet intersect. The base [1-3:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-54.2.7, as derived from the application of a print to root-54.2.

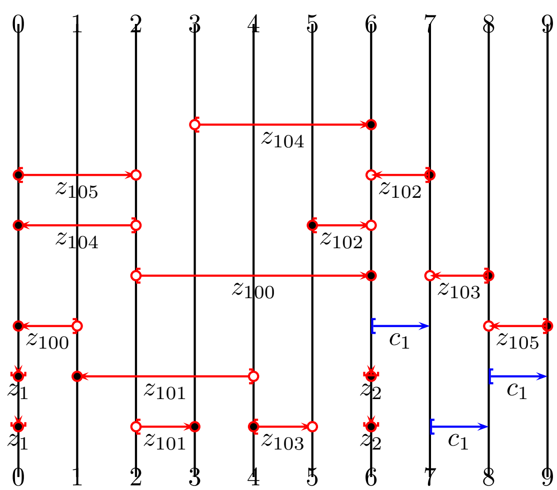
## Generalized Equation root-54.2.8

We begin from the GE root-54.2 (see pp. 344). We consider its print

```
Print 8: =0=3*<4*<1<2<5*<6*<3=7*
```

**Sequence of actions in performing the Print 8:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 9.
Step 4: Moved (old) base [1-3:z100+.] to (new) boundaries 5 - 9.
Step 5: Moved (old) base [1-2:z101+.] to (new) boundaries 5 - 6.
Step 6: Moved (old) base [2-3:z104+.] to (new) boundaries 6 - 9.
Step 7: Moved (old) base [0-1:z104-.] to (new) boundaries 3 - 5.
Step 8: Moved (old) base [0-1:z105+.] to (new) boundaries 3 - 5.
Step 9: Collapsed (new) base [3-9:z2+.] to the empty base (9,9).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-54.2.8—is illustrated below:




**GE Information**: Carrier: [0-2:z104-.] ; Carrier Dual: [3-6:z104+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [2-3:z101+.] and its dual are of opposite polarity, yet intersect. The base [1-4:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-54.2.8, as derived from the application of a print to root-54.2.

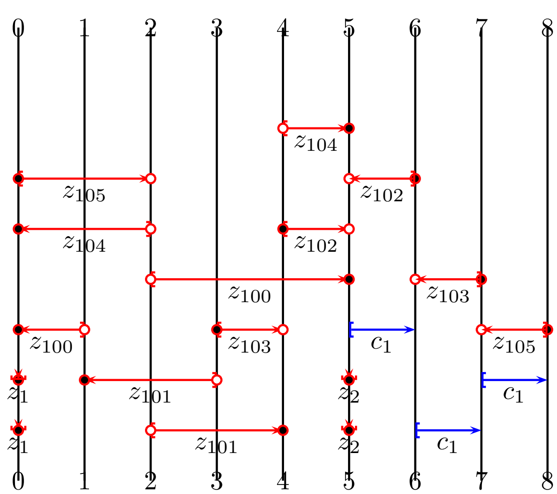
## Generalized Equation root-54.2.9

We begin from the GE root-54.2 (see pp. 344). We consider its print

```
Print 9: =0=3*<4*<1<5*<2=6*<3=7*
```

**Sequence of actions in performing the Print 9:**
Step 1: Added (new) boundary 5.
Step 2: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 3: Moved (old) base [1-3:z100+.] to (new) boundaries 5 - 8.
Step 4: Moved (old) base [1-2:z101+.] to (new) boundaries 5 - 7.
Step 5: Moved (old) base [2-3:z104+.] to (new) boundaries 7 - 8.
Step 6: Moved (old) base [0-1:z104-.] to (new) boundaries 3 - 5.
Step 7: Moved (old) base [0-1:z105+.] to (new) boundaries 3 - 5.
Step 8: Collapsed (new) base [3-8:z2+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-54.2.9—is illustrated below:



**GE Information**: Carrier: [0-2:z104-.] ; Carrier Dual: [4-5:z104+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [2-4:z101+.] and its dual are of opposite polarity, yet intersect. The base [1-3:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-54.2.9, as derived from the application of a print to root-54.2.

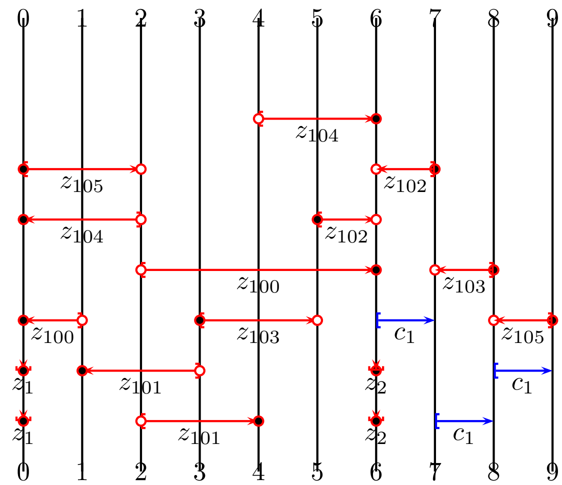
## Generalized Equation root-54.2.10

We begin from the GE root-54.2 (see pp. 344). We consider its print

```
Print 10: =0=3*<4*<1<5*<2<6*<3=7*
```

**Sequence of actions in performing the Print 10:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 9.
Step 4: Moved (old) base [1-3:z100+.] to (new) boundaries 5 - 9.
Step 5: Moved (old) base [1-2:z101+.] to (new) boundaries 5 - 7.
Step 6: Moved (old) base [2-3:z104+.] to (new) boundaries 7 - 9.
Step 7: Moved (old) base [0-1:z104-.] to (new) boundaries 3 - 5.
Step 8: Moved (old) base [0-1:z105+.] to (new) boundaries 3 - 5.
Step 9: Collapsed (new) base [3-9:z2+.] to the empty base (9,9).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-54.2.10—is illustrated below:




**GE Information**: Carrier: [0-2:z104-.] ; Carrier Dual: [4-6:z104+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [2-4:z101+.] and its dual are of opposite polarity, yet intersect. The base [1-3:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-54.2.10, as derived from the application of a print to root-54.2.

## Generalized Equation root-54.2.11

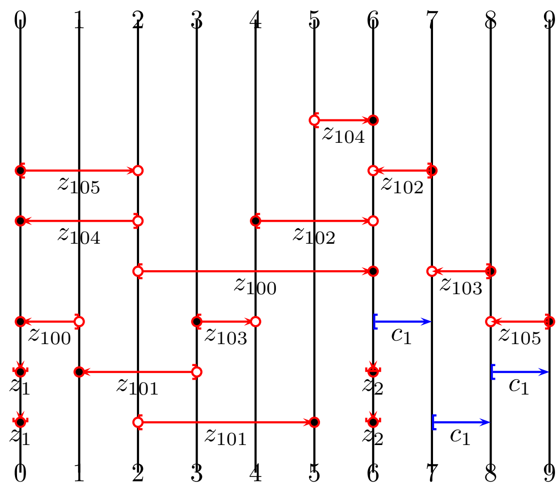
We begin from the GE root-54.2 (see pp. 344). We consider its print

```
Print 11: =0=3*<4*<1<5*<6*<2<3=7*
```

**Sequence of actions in performing the Print 11:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 8.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 9.
Step 4: Moved (old) base [1-3:z100+.] to (new) boundaries 5 - 9.
Step 5: Moved (old) base [1-2:z101+.] to (new) boundaries 5 - 8.
Step 6: Moved (old) base [2-3:z104+.] to (new) boundaries 8 - 9.
Step 7: Moved (old) base [0-1:z104-.] to (new) boundaries 3 - 5.
Step 8: Moved (old) base [0-1:z105+.] to (new) boundaries 3 - 5.
Step 9: Collapsed (new) base [3-9:z2+.] to the empty base (9,9).
Step 10: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Step 11: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

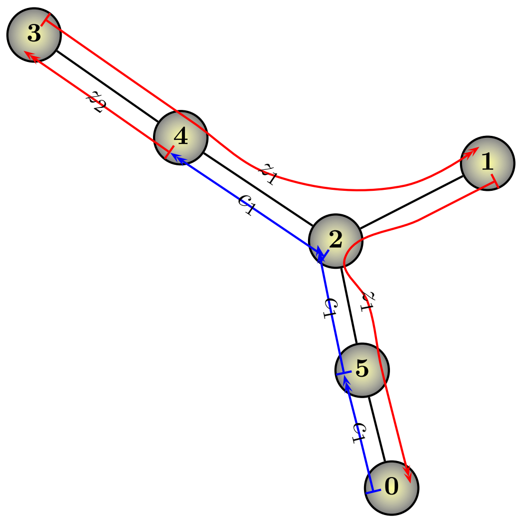
Upon applying the print, the GE we obtain—which we refer to as root-54.2.11—is illustrated below:




**GE Information**: Carrier: [0-2:z104-.] ; Carrier Dual: [5-6:z104+.] ; Critical Boundary: 1; Observe the following facts about this GE: The base [2-5:z101+.] and its dual are of opposite polarity, yet intersect. The base [1-3:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-54.2.11, as derived from the application of a print to root-54.2.

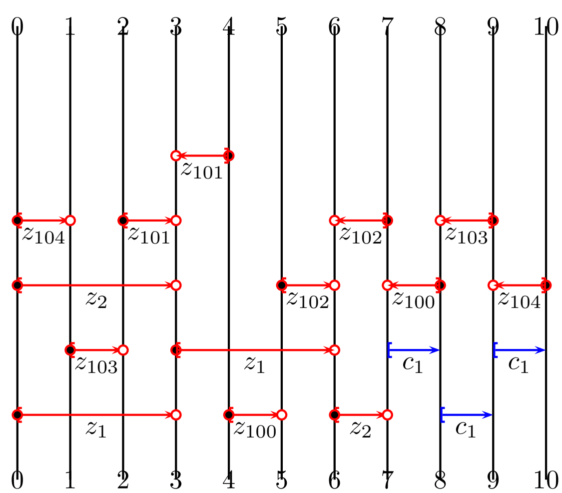
# 55 Cancellation scheme #55




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 5 \leftarrow 0$ |
| $z_1$ | $3 \leftarrow 4 \leftarrow 2 \leftarrow 1$ |
| $z_2$ | $4 \leftarrow 3$ |
| $c_1$ | $2 \leftarrow 4$ |
| $c_1$ | $5 \leftarrow 2$ |
| $c_1$ | $0 \leftarrow 5$ |

## Generalized Equation root-55

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-3:z1+.] ; Carrier Dual: [3-6:z1+.] ; Critical Boundary: 3; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 12 valid prints (descendents).

It has 12 legal carrier-to-dual prints, as follows:

```
Print 1: =0=3*<1<2<4*<5*<3=6*
Print 2: =0=3*<1=4*<2=5*<3=6*
Print 3: =0=3*<1=4*<2<5*<3=6*
Print 4: =0=3*<1=4*<5*<2<3=6*
Print 5: =0=3*<1<4*<2=5*<3=6*
Print 6: =0=3*<1<4*<2<5*<3=6*
Print 7: =0=3*<1<4*<5*<2<3=6*
Print 8: =0=3*<4*<1<2=5*<3=6*
Print 9: =0=3*<4*<1<2<5*<3=6*
Print 10: =0=3*<4*<1=5*<2<3=6*
Print 11: =0=3*<4*<1<5*<2<3=6*
Print 12: =0=3*<4*<5*<1<2<3=6*
```

We proceed.

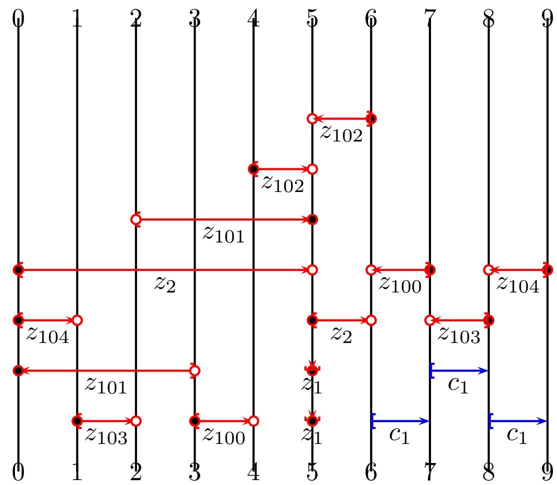
## Generalized Equation root-55.1

We begin from the GE root-55 (see pp. 363). We consider its print

```
Print 1: =0=3*<1<2<4*<5*<3=6*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 5.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 5: Moved (old) base [2-3:z101+.] to (new) boundaries 5 - 8.
Step 6: Moved (old) base [1-2:z103+.] to (new) boundaries 4 - 5.
Step 7: Moved (old) base [0-1:z104+.] to (new) boundaries 3 - 4.
Step 8: Collapsed (new) base [3-8:z1+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-55.1—is illustrated below:




**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-6:z2+.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [2-5:z101+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-55.1, as derived from the application of a print to root-55.

## Generalized Equation root-55.2

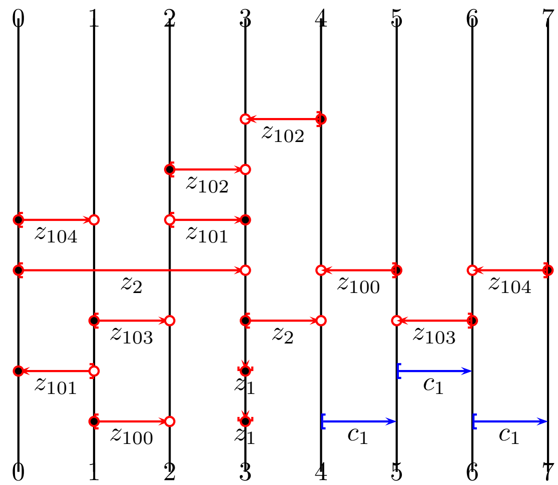
We begin from the GE root-55 (see pp. 363). We consider its print

```
Print 2: =0=3*<1=4*<2=5*<3=6*
```

**Sequence of actions in performing the Print 2:**
Step 1: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 6.
Step 2: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 6.
Step 3: Moved (old) base [2-3:z101+.] to (new) boundaries 5 - 6.
Step 4: Moved (old) base [1-2:z103+.] to (new) boundaries 4 - 5.
Step 5: Moved (old) base [0-1:z104+.] to (new) boundaries 3 - 4.
Step 6: Collapsed (new) base [3-6:z1+.] to the empty base (6,6).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 2 because it is not used inside any base. This

will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-55.2—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-4:z2+.] ; Critical Boundary: 3; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 1 valid prints (descendents).

It has 1 legal carrier-to-dual prints, as follows:

```
Print 1: =0=3*<1<2<3=4*
```

This completes the consideration of root-55.2, as derived from the application of a print to root-55.

## Generalized Equation root-55.3

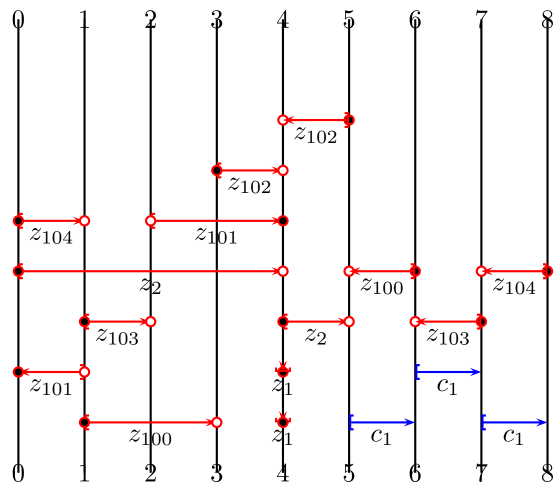
We begin from the GE root-55 (see pp. 363). We consider its print

```
Print 3: =0=3*<1=4*<2<5*<3=6*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 5.
Step 2: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 7.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [2-3:z101+.] to (new) boundaries 5 - 7.
Step 5: Moved (old) base [1-2:z103+.] to (new) boundaries 4 - 5.
Step 6: Moved (old) base [0-1:z104+.] to (new) boundaries 3 - 4.
Step 7: Collapsed (new) base [3-7:z1+.] to the empty base (7,7).

Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-55.3—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-5:z2+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [5-6:z100-.] has constraints with its dual that stretch the constant segment 5 - 6 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-55.3, as derived from the application of a print to root-55.

## Generalized Equation root-55.4

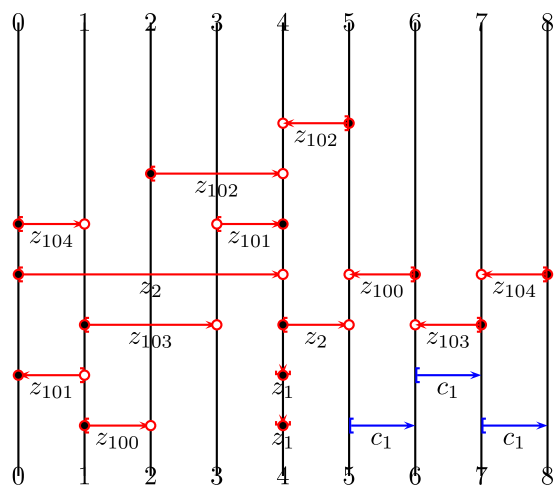
We begin from the GE root-55 (see pp. 363). We consider its print

```
Print 4: =0=3*<1=4*<5*<2<3=6*
```

**Sequence of actions in performing the Print 4:**
Step 1: Added (new) boundary 6.
Step 2: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 7.

Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [2-3:z101+.] to (new) boundaries 6 - 7.
Step 5: Moved (old) base [1-2:z103+.] to (new) boundaries 4 - 6.
Step 6: Moved (old) base [0-1:z104+.] to (new) boundaries 3 - 4.
Step 7: Collapsed (new) base [3-7:z1+.] to the empty base (7,7).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-55.4—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-5:z2+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [6-7:z103-.] has constraints with its dual that stretch the constant segment 6 - 7 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-55.4, as derived from the application of a print to root-55.

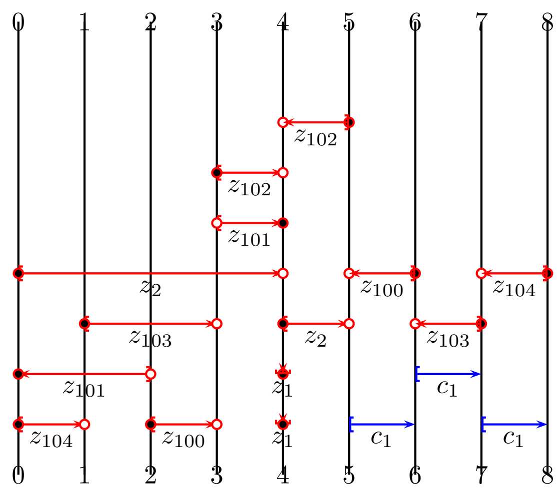
## Generalized Equation root-55.5

We begin from the GE root-55 (see pp. 363). We consider its print

```
Print 5: =0=3*<1<4*<2=5*<3=6*
```

**Sequence of actions in performing the Print 5:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 7.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [2-3:z101+.] to (new) boundaries 6 - 7.
Step 5: Moved (old) base [1-2:z103+.] to (new) boundaries 4 - 6.
Step 6: Moved (old) base [0-1:z104+.] to (new) boundaries 3 - 4.
Step 7: Collapsed (new) base [3-7:z1+.] to the empty base (7,7).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-55.5—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-5:z2+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [6-7:z103-.] has constraints with its dual that stretch the constant segment 6 - 7 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-55.5, as derived from the application of a print to root-55.

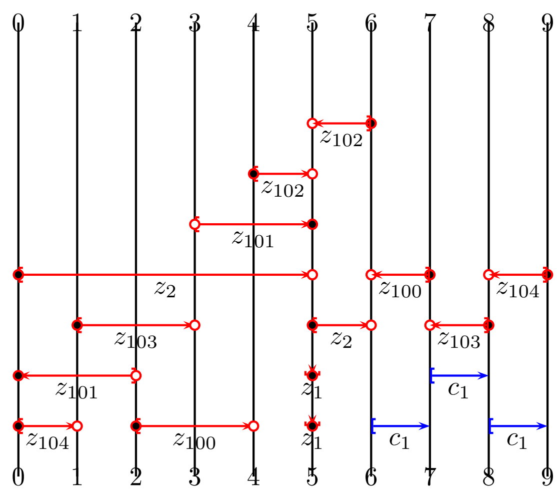
## Generalized Equation root-55.6

We begin from the GE root-55 (see pp. 363). We consider its print

```
Print 6: =0=3*<1<4*<2<5*<3=6*
```

**Sequence of actions in performing the Print 6:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 5: Moved (old) base [2-3:z101+.] to (new) boundaries 6 - 8.
Step 6: Moved (old) base [1-2:z103+.] to (new) boundaries 4 - 6.
Step 7: Moved (old) base [0-1:z104+.] to (new) boundaries 3 - 4.
Step 8: Collapsed (new) base [3-8:z1+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-55.6—is illustrated below:




**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-6:z2+.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [6-7:z100-.] has constraints with its dual that stretch the constant segment 6 - 7 to length different from 1. The base [7-8:z103-.] has constraints with its dual that stretch the constant segment 7 - 8 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-55.6, as derived from the application of a print to root-55.

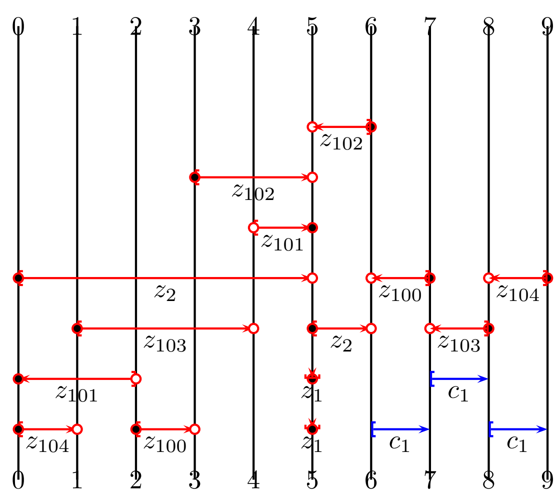
## Generalized Equation root-55.7

We begin from the GE root-55 (see pp. 363). We consider its print

```
Print 7: =0=3*<1<4*<5*<2<3=6*
```

**Sequence of actions in performing the Print 7:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 5: Moved (old) base [2-3:z101+.] to (new) boundaries 7 - 8.
Step 6: Moved (old) base [1-2:z103+.] to (new) boundaries 4 - 7.
Step 7: Moved (old) base [0-1:z104+.] to (new) boundaries 3 - 4.
Step 8: Collapsed (new) base [3-8:z1+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-55.7—is illustrated below:



**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-6:z2+.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [7-8:z103-.] has constraints with its dual that stretch the constant segment 7 - 8 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-55.7, as derived from the application of a print to root-55.

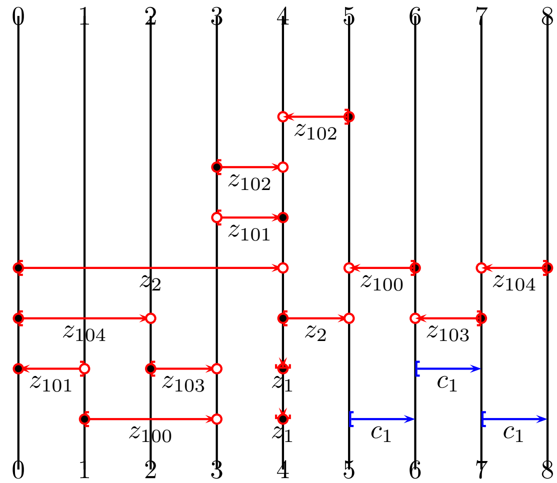
## Generalized Equation root-55.8

We begin from the GE root-55 (see pp. 363). We consider its print

```
Print 8: =0=3*<4*<1<2=5*<3=6*
```

**Sequence of actions in performing the Print 8:**
Step 1: Added (new) boundary 5.
Step 2: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 7.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.
Step 4: Moved (old) base [2-3:z101+.] to (new) boundaries 6 - 7.
Step 5: Moved (old) base [1-2:z103+.] to (new) boundaries 5 - 6.
Step 6: Moved (old) base [0-1:z104+.] to (new) boundaries 3 - 5.
Step 7: Collapsed (new) base [3-7:z1+.] to the empty base (7,7).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-55.8—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-5:z2+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [5-6:z100-.] has constraints with its dual that stretch the constant segment 5 - 6 to length different from 1. The base [7-8:z104-.] has constraints with its dual that stretch the constant segment 7 - 8 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-55.8, as derived from the application of a print to root-55.

## Generalized Equation root-55.9

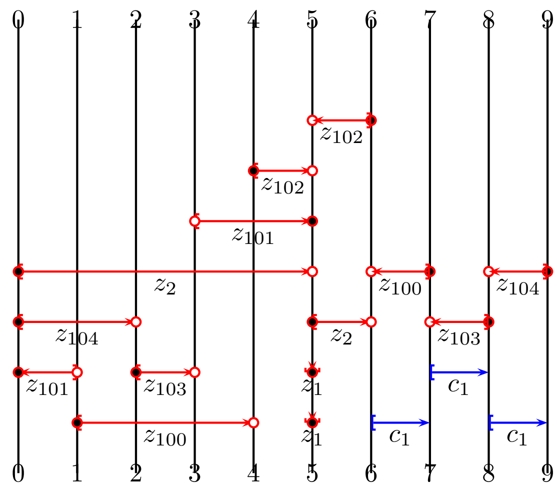
We begin from the GE root-55 (see pp. 363). We consider its print

```
Print 9: =0=3*<4*<1<2<5*<3=6*
```

**Sequence of actions in performing the Print 9:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 6.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 5: Moved (old) base [2-3:z101+.] to (new) boundaries 6 - 8.
Step 6: Moved (old) base [1-2:z103+.] to (new) boundaries 5 - 6.
Step 7: Moved (old) base [0-1:z104+.] to (new) boundaries 3 - 5.
Step 8: Collapsed (new) base [3-8:z1+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-55.9—is illustrated below:




**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-6:z2+.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [6-7:z100-.] has constraints with its dual that stretch the constant segment 6 - 7 to length different from 1. The base [8-9:z104-.] has constraints with its dual that stretch the constant segment 8 - 9 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-55.9, as derived from the application of a print to root-55.

## Generalized Equation root-55.10

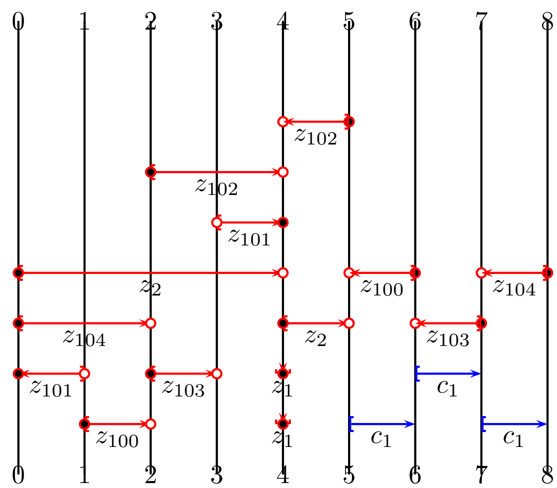
We begin from the GE root-55 (see pp. 363). We consider its print

```
Print 10: =0=3*<4*<1=5*<2<3=6*
```

**Sequence of actions in performing the Print 10:**
Step 1: Added (new) boundary 6.
Step 2: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 7.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 7.

Step 4: Moved (old) base [2-3:z101+.] to (new) boundaries 6 - 7.
Step 5: Moved (old) base [1-2:z103+.] to (new) boundaries 5 - 6.
Step 6: Moved (old) base [0-1:z104+.] to (new) boundaries 3 - 5.
Step 7: Collapsed (new) base [3-7:z1+.] to the empty base (7,7).
Step 8: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 9: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-55.10—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-5:z2+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [7-8:z104-.] has constraints with its dual that stretch the constant segment 7 - 8 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-55.10, as derived from the application of a print to root-55.

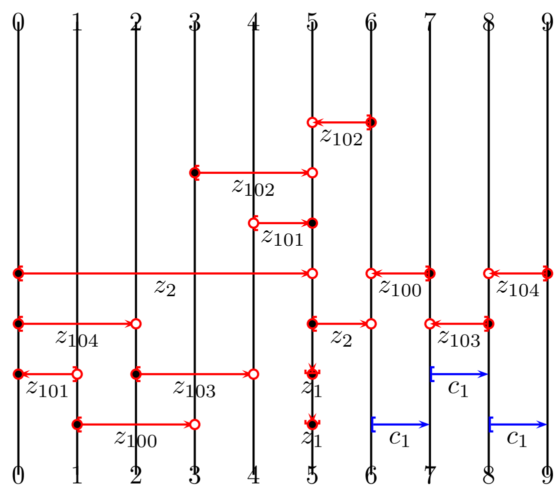
## Generalized Equation root-55.11

We begin from the GE root-55 (see pp. 363). We consider its print

```
Print 11: =0=3*<4*<1<5*<2<3=6*
```

**Sequence of actions in performing the Print 11:**
Step 1: Added (new) boundary 5.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 5: Moved (old) base [2-3:z101+.] to (new) boundaries 7 - 8.
Step 6: Moved (old) base [1-2:z103+.] to (new) boundaries 5 - 7.
Step 7: Moved (old) base [0-1:z104+.] to (new) boundaries 3 - 5.
Step 8: Collapsed (new) base [3-8:z1+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-55.11—is illustrated below:




**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-6:z2+.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [6-7:z100-.] has constraints with its dual that stretch the constant segment 6 - 7 to length different from 1. The base [7-8:z103-.] has constraints with its dual that stretch the constant segment 7 - 8 to length different from 1. The base [8-9:z104-.] has constraints with its dual that stretch the constant segment 8 - 9 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-55.11, as derived from the application of a print to root-55.

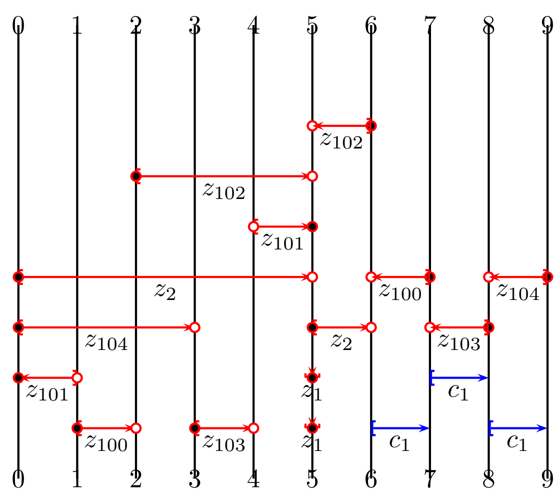
## Generalized Equation root-55.12

We begin from the GE root-55 (see pp. 363). We consider its print

```
Print 12: =0=3*<4*<5*<1<2<3=6*
```

**Sequence of actions in performing the Print 12:**
Step 1: Added (new) boundary 6.
Step 2: Added (new) boundary 7.
Step 3: Moved (old) base [0-3:z1+.] to (new) boundaries 3 - 8.
Step 4: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 8.
Step 5: Moved (old) base [2-3:z101+.] to (new) boundaries 7 - 8.
Step 6: Moved (old) base [1-2:z103+.] to (new) boundaries 6 - 7.
Step 7: Moved (old) base [0-1:z104+.] to (new) boundaries 3 - 6.
Step 8: Collapsed (new) base [3-8:z1+.] to the empty base (8,8).
Step 9: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 10: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 11: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-55.12—is illustrated below:




**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-6:z2+.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [8-9:z104-.] has constraints with its dual that stretch the constant segment 8 - 9 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-55.12, as derived from the application of a print to root-55.

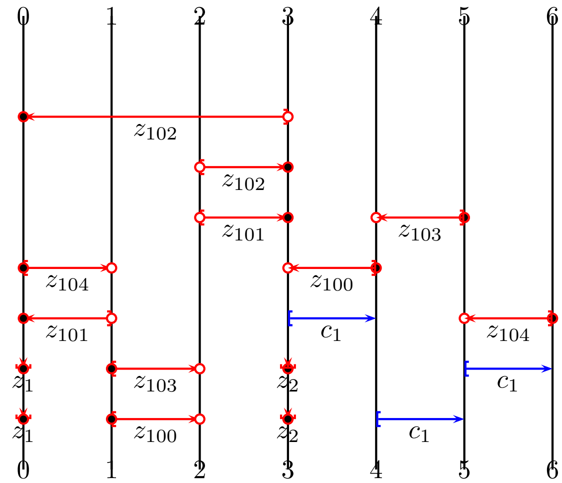
## Generalized Equation root-55.2.1

We begin from the GE root-55.2 (see pp. 365). We consider its print

```
Print 1: =0=3*<1<2<3=4*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 4.
Step 2: Added (new) boundary 5.
Step 3: Moved (old) base [0-3:z2+.] to (new) boundaries 3 - 6.
Step 4: Moved (old) base [1-2:z100+.] to (new) boundaries 4 - 5.
Step 5: Moved (old) base [2-3:z101+.] to (new) boundaries 5 - 6.
Step 6: Moved (old) base [0-1:z101-.] to (new) boundaries 3 - 4.
Step 7: Moved (old) base [2-3:z102+.] to (new) boundaries 5 - 6.
Step 8: Moved (old) base [1-2:z103+.] to (new) boundaries 4 - 5.
Step 9: Moved (old) base [0-1:z104+.] to (new) boundaries 3 - 4.
Step 10: Collapsed (new) base [3-6:z2+.] to the empty base (6,6).
Step 11: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 12: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 13: Deleted (new) boundary 2 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

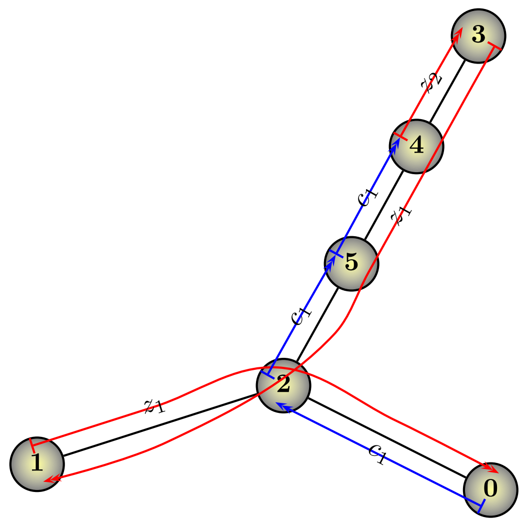
Upon applying the print, the GE we obtain—which we refer to as root-55.2.1—is illustrated below:




**GE Information**: Carrier: [0-3:z102-.] ; Carrier Dual: [2-3:z102+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [2-3:z102+.] and its dual are of opposite polarity, yet intersect. The base [0-3:z102-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-55.2.1, as derived from the application of a print to root-55.2.

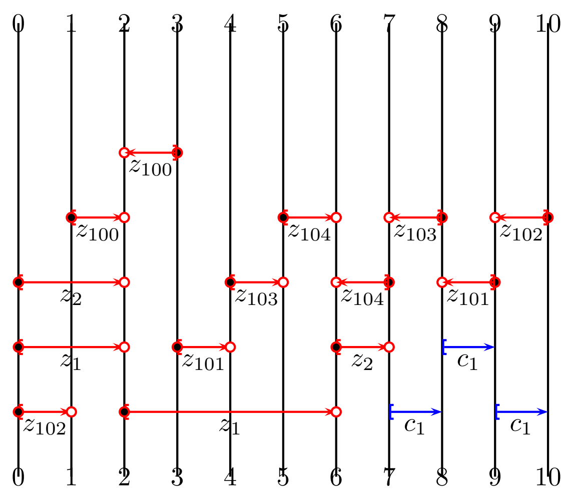
# 56 Cancellation scheme #56




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 0$ |
| $z_1$ | $3 \leftarrow 4 \leftarrow 5 \leftarrow 2 \leftarrow 1$ |
| $z_2$ | $4 \leftarrow 3$ |
| $c_1$ | $5 \leftarrow 4$ |
| $c_1$ | $2 \leftarrow 5$ |
| $c_1$ | $0 \leftarrow 2$ |

## Generalized Equation root-56

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-2:z1+.] ; Carrier Dual: [2-6:z1+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 6 valid prints (descendents).

It has 6 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1<3*<4*<5*<2=6*
Print 2: =0=2*<3*<1=4*<5*<2=6*
Print 3: =0=2*<3*<1<4*<5*<2=6*
Print 4: =0=2*<3*<4*<1=5*<2=6*
Print 5: =0=2*<3*<4*<1<5*<2=6*
Print 6: =0=2*<3*<4*<5*<1<2=6*
```

We proceed.

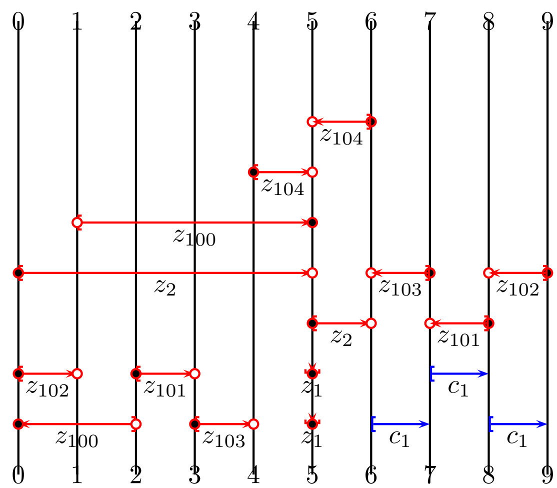
## Generalized Equation root-56.1

We begin from the GE root-56 (see pp. 380). We consider its print

```
Print 1: =0=2*<1<3*<4*<5*<2=6*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 7.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 7.
Step 4: Moved (old) base [1-2:z100+.] to (new) boundaries 3 - 7.
Step 5: Moved (old) base [0-1:z102+.] to (new) boundaries 2 - 3.
Step 6: Collapsed (new) base [2-7:z1+.] to the empty base (7,7).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-56.1—is illustrated below:




**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-6:z2+.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [1-5:z100+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z100-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-56.1, as derived from the application of a print to root-56.

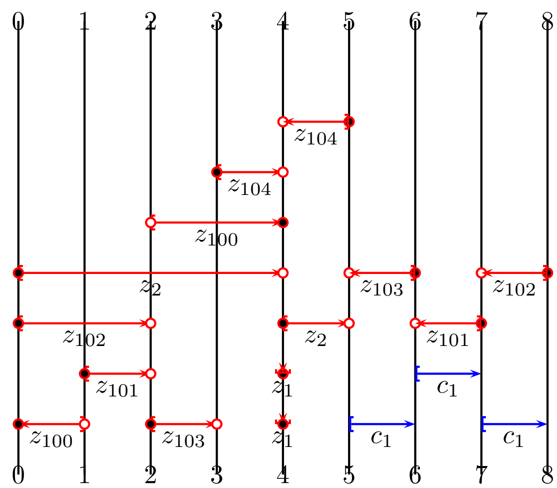
## Generalized Equation root-56.2

We begin from the GE root-56 (see pp. 380). We consider its print

```
Print 2: =0=2*<3*<1=4*<5*<2=6*
```

**Sequence of actions in performing the Print 2:**
Step 1: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 6.
Step 2: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 6.
Step 3: Moved (old) base [1-2:z100+.] to (new) boundaries 4 - 6.
Step 4: Moved (old) base [0-1:z102+.] to (new) boundaries 2 - 4.
Step 5: Collapsed (new) base [2-6:z1+.] to the empty base (6,6).
Step 6: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 7: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-56.2—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-5:z2+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [7-8:z102-.] has constraints with its dual that stretch the constant segment 7 - 8 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-56.2, as derived from the application of a print to root-56.

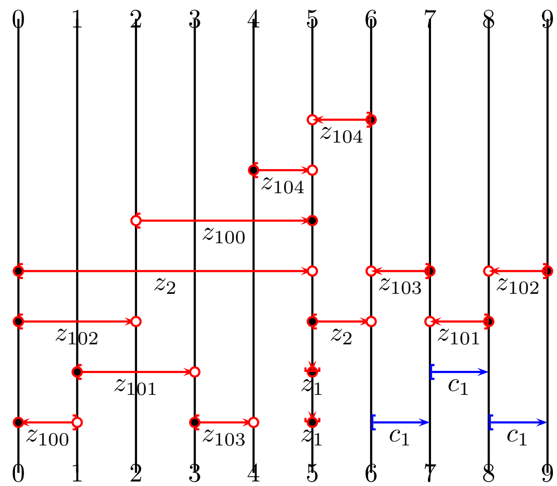
## Generalized Equation root-56.3

We begin from the GE root-56 (see pp. 380). We consider its print

```
Print 3: =0=2*<3*<1<4*<5*<2=6*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 7.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 7.
Step 4: Moved (old) base [1-2:z100+.] to (new) boundaries 4 - 7.
Step 5: Moved (old) base [0-1:z102+.] to (new) boundaries 2 - 4.
Step 6: Collapsed (new) base [2-7:z1+.] to the empty base (7,7).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-56.3—is illustrated below:




**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-6:z2+.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [7-8:z101-.] has constraints with its dual that stretch the constant segment 7 - 8 to length different from 1. The base [8-9:z102-.] has constraints with its dual that stretch the constant segment 8 - 9 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-56.3, as derived from the application of a print to root-56.

## Generalized Equation root-56.4

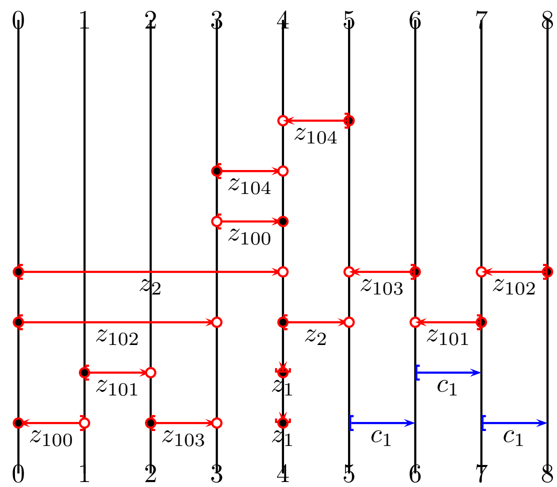
We begin from the GE root-56 (see pp. 380). We consider its print

```
Print 4: =0=2*<3*<4*<1=5*<2=6*
```

**Sequence of actions in performing the Print 4:**
Step 1: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 6.
Step 2: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 6.
Step 3: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 6.
Step 4: Moved (old) base [0-1:z102+.] to (new) boundaries 2 - 5.
Step 5: Collapsed (new) base [2-6:z1+.] to the empty base (6,6).
Step 6: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 7: Deleted (new) boundary 1 because it is not used inside any base. This

will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-56.4—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-5:z2+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [7-8:z102-.] has constraints with its dual that stretch the constant segment 7 - 8 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-56.4, as derived from the application of a print to root-56.

## Generalized Equation root-56.5

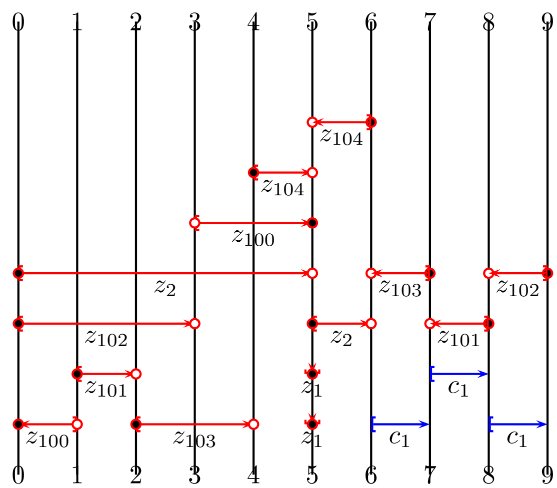
We begin from the GE root-56 (see pp. 380). We consider its print

```
Print 5: =0=2*<3*<4*<1<5*<2=6*
```

**Sequence of actions in performing the Print 5:**
Step 1: Added (new) boundary 5.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 7.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 7.
Step 4: Moved (old) base [1-2:z100+.] to (new) boundaries 5 - 7.
Step 5: Moved (old) base [0-1:z102+.] to (new) boundaries 2 - 5.
Step 6: Collapsed (new) base [2-7:z1+.] to the empty base (7,7).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This

will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-56.5—is illustrated below:




**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-6:z2+.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [6-7:z103-.] has constraints with its dual that stretch the constant segment 6 - 7 to length different from 1. The base [8-9:z102-.] has constraints with its dual that stretch the constant segment 8 - 9 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-56.5, as derived from the application of a print to root-56.

## Generalized Equation root-56.6

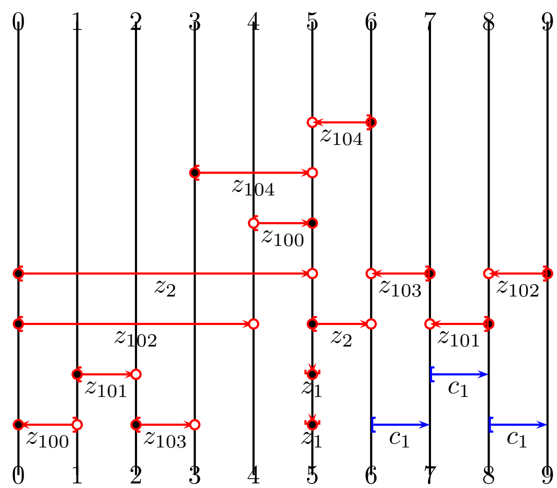
We begin from the GE root-56 (see pp. 380). We consider its print

```
Print 6: =0=2*<3*<4*<5*<1<2=6*
```

**Sequence of actions in performing the Print 6:**
Step 1: Added (new) boundary 6.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 7.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 7.
Step 4: Moved (old) base [1-2:z100+.] to (new) boundaries 6 - 7.

Step 5: Moved (old) base [0-1:z102+.] to (new) boundaries 2 - 6.
Step 6: Collapsed (new) base [2-7:z1+.] to the empty base (7,7).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

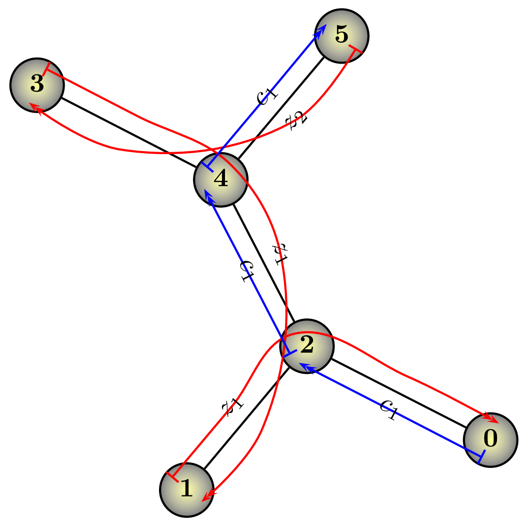
Upon applying the print, the GE we obtain—which we refer to as root-56.6—is illustrated below:




**GE Information**: Carrier: [0-5:z2+.] ; Carrier Dual: [5-6:z2+.] ; Critical Boundary: 5; Observe the following facts about this GE: The base [8-9:z102-.] has constraints with its dual that stretch the constant segment 8 - 9 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-56.6, as derived from the application of a print to root-56.

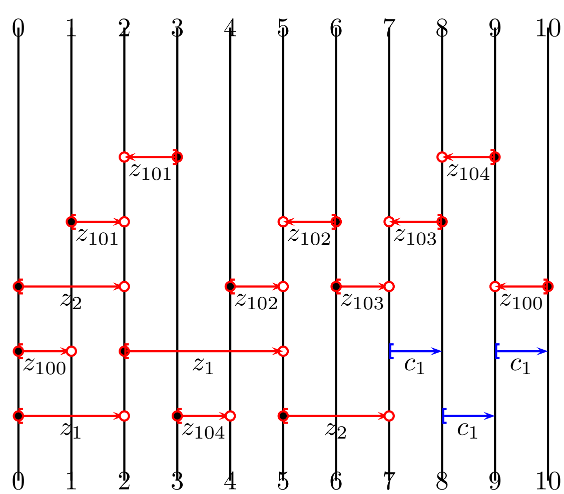
# 57 Cancellation scheme #57




| | |
|---|---|
| $z_1$ | $1 \leftarrow 2 \leftarrow 0$ |
| $z_1$ | $3 \leftarrow 4 \leftarrow 2 \leftarrow 1$ |
| $z_2$ | $5 \leftarrow 4 \leftarrow 3$ |
| $c_1$ | $4 \leftarrow 5$ |
| $c_1$ | $2 \leftarrow 4$ |
| $c_1$ | $0 \leftarrow 2$ |

## Generalized Equation root-57

Below is the root GE obtained from the cancellation diagram above.



**GE Information**: Carrier: [0-2:z1+.] ; Carrier Dual: [2-5:z1+.] ; Critical Boundary: 2; The GE above is non-degenerate. This GE is *not* a leaf in the GE tree. It has 4 valid prints (descendents).

It has 4 legal carrier-to-dual prints, as follows:

```
Print 1: =0=2*<1<3*<4*<2=5*
Print 2: =0=2*<3*<1=4*<2=5*
Print 3: =0=2*<3*<1<4*<2=5*
Print 4: =0=2*<3*<4*<1<2=5*
```

We proceed.

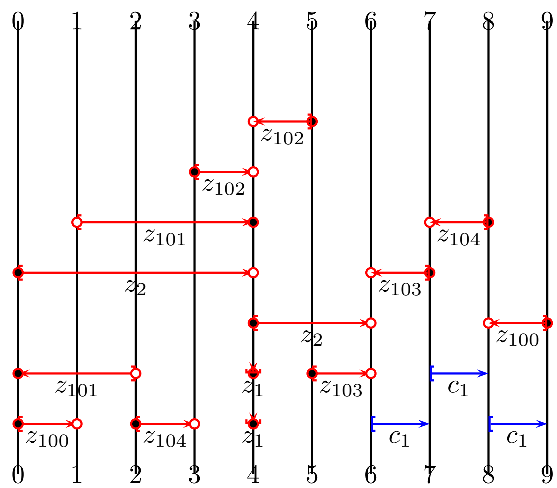
## Generalized Equation root-57.1

We begin from the GE root-57 (see pp. 388). We consider its print

```
Print 1: =0=2*<1<3*<4*<2=5*
```

**Sequence of actions in performing the Print 1:**
Step 1: Added (new) boundary 3.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 6.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 6.
Step 4: Moved (old) base [0-1:z100+.] to (new) boundaries 2 - 3.
Step 5: Moved (old) base [1-2:z101+.] to (new) boundaries 3 - 6.
Step 6: Collapsed (new) base [2-6:z1+.] to the empty base (6,6).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-57.1—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-6:z2+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [1-4:z101+.] and its dual are of opposite polarity, yet intersect. The base [0-2:z101-.] and its dual are of opposite polarity, yet intersect. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-57.1, as derived from the application of a print to root-57.

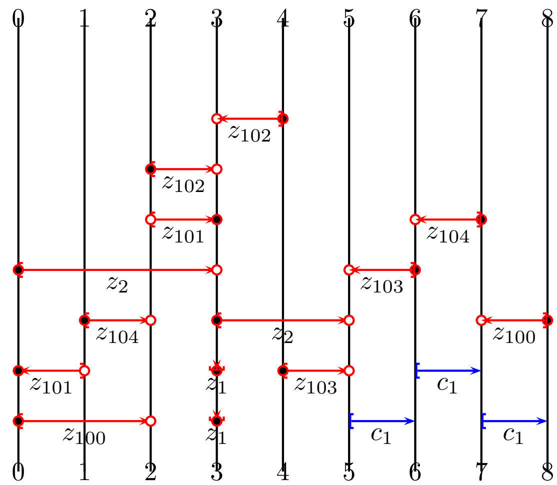
## Generalized Equation root-57.2

We begin from the GE root-57 (see pp. 388). We consider its print

```
Print 2: =0=2*<3*<1=4*<2=5*
```

**Sequence of actions in performing the Print 2:**
Step 1: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 5.
Step 2: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 5.
Step 3: Moved (old) base [0-1:z100+.] to (new) boundaries 2 - 4.
Step 4: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 5.
Step 5: Collapsed (new) base [2-5:z1+.] to the empty base (5,5).
Step 6: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 7: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-57.2—is illustrated below:




**GE Information**: Carrier: [0-3:z2+.] ; Carrier Dual: [3-5:z2+.] ; Critical Boundary: 3; Observe the following facts about this GE: The base [7-8:z100-.] has constraints with its dual that stretch the constant segment 7 - 8 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-57.2, as derived from the application of a print to root-57.

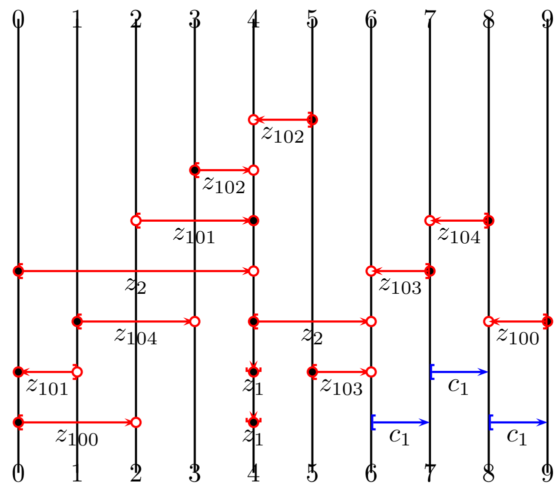
## Generalized Equation root-57.3

We begin from the GE root-57 (see pp. 388). We consider its print

```
Print 3: =0=2*<3*<1<4*<2=5*
```

**Sequence of actions in performing the Print 3:**
Step 1: Added (new) boundary 4.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 6.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 6.
Step 4: Moved (old) base [0-1:z100+.] to (new) boundaries 2 - 4.
Step 5: Moved (old) base [1-2:z101+.] to (new) boundaries 4 - 6.
Step 6: Collapsed (new) base [2-6:z1+.] to the empty base (6,6).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.
Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-57.3—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-6:z2+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [7-8:z104-.] has constraints with its dual that stretch the constant segment 7 - 8 to length different from 1. The base [8-9:z100-.] has constraints with its dual that stretch the constant segment 8 - 9 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-57.3, as derived from the application of a print to root-57.

## Generalized Equation root-57.4

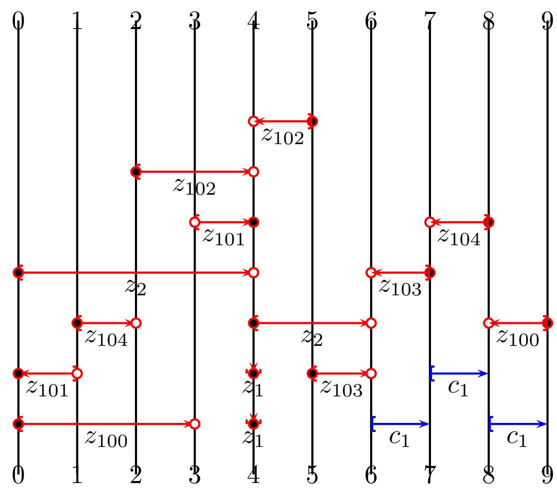
We begin from the GE root-57 (see pp. 388). We consider its print

```
Print 4: =0=2*<3*<4*<1<2=5*
```

**Sequence of actions in performing the Print 4:**
Step 1: Added (new) boundary 5.
Step 2: Moved (old) base [0-2:z1+.] to (new) boundaries 2 - 6.
Step 3: Moved (old) base [0-2:z2+.] to (new) boundaries 2 - 6.
Step 4: Moved (old) base [0-1:z100+.] to (new) boundaries 2 - 5.
Step 5: Moved (old) base [1-2:z101+.] to (new) boundaries 5 - 6.
Step 6: Collapsed (new) base [2-6:z1+.] to the empty base (6,6).
Step 7: Deleted (new) boundary 0 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Step 8: Deleted (new) boundary 1 because it is not used inside any base. This will cause renumbering of higher numbered boundaries.

Upon applying the print, the GE we obtain—which we refer to as root-57.4—is illustrated below:




**GE Information**: Carrier: [0-4:z2+.] ; Carrier Dual: [4-6:z2+.] ; Critical Boundary: 4; Observe the following facts about this GE: The base [8-9:z100-.] has constraints with its dual that stretch the constant segment 8 - 9 to length different from 1. These observations show that the GE above is degenerate. This GE is a leaf in the GE tree. This branch of the tree has led us to a dead end.

This completes the consideration of root-57.4, as derived from the application of a print to root-57.

# 58 Acknowledgements

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